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THE MUSEUM

OF

NATURAL HISTORY

BEING A POPULAR ACCOUNT OF THE
STRUCTURE, HABITS, AND CLASSIFICATION OF THE VARIOUS DEPARTMENTS OF

THE ANIMAL KINGDOM

Quadrupeds, Birds, Reptiles, Fishes, Shells, and Insects

INCLUDING THE INSECTS DESTRUCTIVE TO AGRICULTURE.

BY

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WITH A

HISTORY OF THE AMERICAN FAUNA

BY

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PREFACE.

This History of the American Fauna is designed to furnish an abstract of the present knowledge relating to the Zoology of the American Continent, in connection with and supplementary to a more extended work, the combined efforts of the eminent British Zoologists whose names are borne on the title-page.

The excellent and exhaustive monographs and reports published by the Smithsonian Institution, and the Interior and War Departments, have placed on record a vast amount of valuable information on American Zoology, which, however, is to many inaccessible. It has been our endeavor to present, through the courtesy of the authors, an epitome of the knowledge embodied in the latest publications, including valuable matter, issued in volume, brochure and essay. The notable absence of any published general source of information concerning American Zoology, has been less felt by reason of our privileges as sojourner with the U. S. Fish Commission. Companionship with its scientific corps, on the several occasions of encampment, is remembered with exceeding pleasure. From its honored chief, Professor S. F. Baird, we have received much kindly advice and courtesy. To Professor Verrill, Director of the Laboratory, and Professors G. Browne Goode and Gill, we are greatly indebted for timely suggestions and valuable information. The charming associations of the encampments of Peake's Island and the "Blue Light," "Off the Skillings," Noank and Gloucester, and the "Speedwell," are all fresh in memory, as periods profitably passed. Professor J. S. Newberry, of Columbia College, and Professor Stevenson, of the University of New York, have also rendered us valuable assistance.

In considering the plan of this work, it was deemed advisable to devote more attention to those branches which were less developed in a popular manner; hence, there is small space given to Insects and Shell-fish, for the reason that there are numerous works, within the reach of all, treating quite exhaustively on these subjects. Greater consideration of the higher forms was regarded as desirable, and these we have endeavored to treat with more completeness as to biography; the specific characters, with reference to the identification of species, could not properly be recorded.

A retrospect of our Zoological field, its aspects from the earliest time, and a glance at the memoirs of its laborers, was a part of our purpose, but our limits allow only the names of the more prominent. Those from whose works we have drawn are mentioned in appropriate places. Observers and writers on Natural History were not wanting in the early days of our Continental History. In 1672, Josselyn published a work in London which he named *New England's Rarities, Discovered in Birds, Beasts, Fishes, Plants, &c.;* and, in 1694, Clayton issued a work, entitled *Beasts and Serpents of Virginia.* In 1698, Hennepen published in Amsterdam a general work of discovery in America, in which is considerable matter relating to the Zoology and Botany of the country. In 1709, Lawson wrote the results of his *Voyage to Carolina,* and afterwards issued other books containing information on Zoological subjects. In 1731, the great work of Catesby, entitled *The Natural*

History of Carolina and Florida, was published. Romans, in 1776, wrote the *Natural History of Florida*. In 1782, Thomas Jefferson, the eminent author of our Declaration of Independence, interested himself in the Zoology of his region, especially of the remarkable fossil forms, then just being discovered. The name of John Bartram is a most honored one in the ranks of American naturalists. His son, William Bartram, inherited his tastes, and is well-known in our annals. Benj. Smith Barton was one of the first professors of Natural History in the United States; born in 1766, died in 1815. In 1784, Belknap, of New Hampshire, incorporated in his history of that State considerable valuable matter on its Zoology. A few years later Williams' *Civil and Natural History of Vermont* appeared.

In 1814, the well-remembered expedition of Lewis and Clark in the undiscovered regions of the Far West was undertaken, and an impetus was thus given to active measures for the unlocking of the great storehouses of American Zoology. At this time Ord was studying the Vertebrates, and issued some account of them in a general work on the *History of North America*. In 1802, Rafinesque, an eccentric young man of twenty, came to this country, professedly as a botanist, but, in after years, wrote extensively on Zoological subjects. An entertaining anecdote of his meeting with Audubon is noticed in our introduction to Cheiroptera. Alexander Wilson settled in Philadelphia in 1794, and, through the acquaintance and example of William Bartram, became enthusiastic as an ornithologist. Wilson's excellent figures of birds, nearly all of life-size, have not been surpassed for fidelity in outline and color, and his text is the very choicest of descriptive English—charming, and the closest transcript of Nature's utterances. John James Audubon was born in Louisiana in 1780, and died in New York, at his beautiful residence on the Hudson, in 1851. He studied drawing in France, under David, and may be said to have been a professional ornithologist by education and practise. In 1810, Wilson met him as a stranger in Kentucky, and was astonished to find the backwoodsman so clever in such pursuits. During the years 1824–25–28, Harlan and Godman wrote on American Mammals. In 1840, the Prince Maximilian, of Germany, travelled through North and South America, and acquired an enormous amount of material in all branches of Zoology. His entire collection is now the property of the American Museum of Natural History, in Central Park, New York.

About this time the valuable *Reports on the Natural History of New York* were issued, edited by Dr. DeKay. Similar work was done for Massachusetts by Mr. Emmons. Since then much more pretentious and valuable works have been published by the State of Massachusetts, written by Gould, Storer, Binney, and others. In 1841, Audubon and Bachmann wrote their great work on *Mammals of North America*. Other writers on Zoology were Holbrook, of Charleston, S. C.; Leidy, Baird, Kennicut and Newberry. Agassiz also gave the weight of his great genius to advance our Zoology. In 1857, Professor Baird produced his great work on *Mammals of North America*, since which, the equally great one on *Birds* has been issued. During the later years, laborers in the various special fields have greatly increased, and a substantial gain is now noticeable in the literature of American Zoology.

J. B. H.

HISTORY

OF

THE AMERICAN FAUNA.

Order I.—BIMANA.

The study of the Natural History of Man embraces almost every branch of human knowledge; it is not, therefore, necessary in this portion of the present work to enter far into its domain.

In accordance with a generally accepted system, we introduce Man as the superior of the Animal Kingdom—the sole representative of the Archencephala—forming one order, and a solitary genus. That Man is thus fairly placed, is the nearly unanimous feeling of naturalists, though it has been the fashion of a few to declare such a bestowal an indignity unworthy of the lordly creature.

Researches bearing upon the question of the progress and antiquity of the human race are, at the present time, pursued with great interest and zeal. The discoveries in caves and superficial deposits, of fragments of pottery and stone implements, and, more rarely, human remains, have led to the belief that Man was coeval with some of the extinct Mammalia. This belief has been largely strengthened by various recent discoveries, particularly in the western portions of North America. It is our purpose here to arrange, as concisely as possible, the facts touching this subject which are extant, and thus present all that can be gleaned of recognized scientific truth.

In the original pages of the main portion of this work will be found, as a commencing chapter, an excellent treatise on the subject of races, and some valuable matter on the psychological and physiological relations of the human form to the next higher Mammalia.

Cuvier, in his character of the order Bimana, affirms that Man is the only animal that possesses hands and feet—"L'homme est le seul animal vraiment bimane et bipède." The Quadrumana are distinguished by having *hands* instead of *feet;* a hand being defined by Owen as having "the structural modification in the genus Homo, more especially those of the pelvic limbs, by which the erect stature and bipedal gait are maintained, such as to claim for Man, on merely external zoological characters, ordinal distinction, at least."

Man's psychological powers, in association with his extraordinarily developed brain, entitle the group which he represents to rank with the primary division of the class Mammalia, founded on cerebral characters. In this class, Man forms but one genus, and that genus is in the one order—Bimana—on account of the opposable thumb being restricted to the upper limb. To arrive at a just conception of Man, we cannot regard him exclusively as an individual being, for he is, as was well observed by Aristotle, a social being. As a single object he is beyond comprehension. Anatomy and physiology alone cannot determine his nature; neither can they, aided by psychology. We strive to know ourselves, but it is our social life that in a great measure furnishes to us knowledge of Man; beyond this, we must look to histories of peoples, and, ultimately, over the entire range of civilization. The testimony of Egyptian antiquities shows, that the civilization of mankind reaches farther back than the period assigned to Adam by the Jewish law-giver, and now we have abundant evidence looking to a period beyond what we were wont to term civilization, yet one disclosing a high order of attainments in certain attributes of mankind.

Dr. Foster, in his recent work, *The Pre-Historic Races of the United States*, says: "The combined investigations of geologists and ethnologists, prosecuted during the last quarter of a century, have thrown much light upon the origin of the human race, and developed facts which require us to essentially modify our pre-existing views as to the length of time during which it has occupied our planet. That Man lived at a time far too remote to be embraced in our received system of chronology, surrounded by great quadrupeds which have ceased to exist, and under a climate very different from what now prevails, has been so clearly demonstrated that the fact must now be accepted as scientific truth."

Sir John Lubbock says: "Ethnology is passing through a phase from which other sciences have safely emerged; and the new view in reference to the antiquity of Man, though still looked upon with distrust and apprehension, will, I doubt not, in a few years be regarded with as little disquietude as are those discoveries in geology and astronomy which at one time excited even greater opposition."

European archæologists have divided their subject-matter into two principal heads: the Stone Age and

the Metal Age. They are further subdivided into epochs, the first having three and the latter two of these periods. The first epoch of the Stone Age includes the Mammoth, the Cave Bear, and other extinct Mammalia. The second epoch, called also the Reindeer Epoch, covers the time when the existing species of Reindeer, the Aurochs (European Bison,) the Wild Ox, the Musk Ox and the Irish Stag, with other smaller animals, were common to the warmer portions of Europe. To the third epoch is referred that portion of the human race which was associated with domesticated existing animals. The latter is called the Polished Stone Epoch, in view of the advanced state of the art of making and finishing the stone implements in use at that time. It is a notable fact that the stone implements found in Central America and the Antilles, and those exhumed from the North American tumuli are, nearly all of them, of the same high finish, both in sculpture and polish, as the European of this epoch.

The Metal Age, with its two epochs of Bronze and of Iron, brings with it somewhat of a history in its monuments, their rude markings and inscriptions, and, in the later time, fairly laps upon the historic or present period.

As early as 1823, M. Boné, an accomplished French geologist, found human bones in the undisturbed Löess, at Lahr, in the valley of the Rhine, which were shown to Cuvier, who, admitting that they were human, could not believe they were of any considerable antiquity. In the year 1828, human bones and teeth were found in the cavern of Bize, in the south of France, with pottery, and intermixed with bones of Mammals now extinct. These were all cemented by stalagmite, and exhibited the same degree of fossilization.

In 1833, Dr. Schmerling found in the cave deposits of Liège human bones and rude implements of stone; these were associated with the bones of the Elephant, Rhinoceros and other Mammals. Schmerling, after devoting several years to the exploring of the numerous ossiferous caverns which border the valley of the Meuse and its tributaries, published two volumes, descriptive of the contents of more than forty caverns. Many of these caverns had never before been entered by scientific observers, and their floors were encrusted by unbroken stalagmite. At a very early stage of his investigations, Dr. Schmerling found the bones of Man so rolled and scattered as to preclude all idea of their having been intentionally buried on the spot. He also remarked that they were of the same color and in the same condition, as to the amount of animal matter contained in them, as those of the accompanying animals, some of which, like the Cave Bear, Hyena, Elephant and Rhinoceros, were extinct; others, like the Wild Cat, Beaver, Wild Boar, Roe-deer, Wolf and Hedgehog, still extant. The fossils were lighter than fresh bones, except such as had their bones filled with carbonate of lime, in which case they were often much heavier. The human remains of most frequent occurrence were teeth detached from the jaw, and carpal, metacarpal, tarsal, metatarsal, and phalangial bones, separated from the rest of the skeleton. The corresponding bones of the Cave Bear, the most abundant of the accompanying Mammalia, were also found in the Liège caverns more commonly than any other, and in the same scattered condition. Occasionally, some of the long bones of the Mammalia were observed to have been first broken across, and then reunited or cemented again by stalagmite, as they lay on the floor of the cave. No example was discovered of an entire skeleton. The incompleteness of each was especially ascertained in regard to the human subjects, Dr. Schmerling being careful, whenever a fragment of such presented itself, to explore the cavern himself and see whether any other bones of the same skeleton could be found. In the Engis Cavern, distant about eight miles from Liège, the remains of at least three human individuals were disinterred. The skull of one of these, that of a young person, was embedded by the side of a Mammoth's tooth. It was entire, but so fragile that nearly all of it fell to pieces during its extraction. Another skull, that of an adult, and the only one preserved by Dr. Schmerling in a sufficient state of integrity to enable the anatomist to speculate on the race to which it belonged, was buried five feet deep in a breccia, in which a tooth of a Rhinoceros, several bones of a Horse, and some of a Reindeer, together with some Ruminants, occurred. This skull is now in the Museum of the University of Liège, and is familiar to science as the *Engis Skull.*

After speaking of his first visit to Dr. Schmerling in 1833, Sir C. Lyell continues: "The year after, I cited Schmerling's opinions, and the facts bearing on the antiquity of Man, in the third edition of my *Principles of Geology*, and in succeeding editions, without pretending to call in question their trustworthiness, but, at the same time, without giving them the weight which I now consider they were entitled to. He had accumulated ample evidence to prove that Man had been introduced into the earth at an earlier period than geologists were then willing to believe.

"To be let down, as Schmerling was, day after day, by a rope tied to a tree, so as to slide to the foot of the first opening of the Engis Cave, where the best-preserved skulls were found; and, after thus gaining access to the first subterranean gallery, to creep on all fours through a contracted passage leading to larger chambers, there to superintend by torch-light, week after week and year after year, the workmen who were breaking through the stalagmitic crust as hard as marble, in order to remove, piece by piece, the underlying bone breccia nearly as hard; to stand for hours with one's feet in the mud, and with water dripping from the roof on one's head, in order to mark the position and guard against the loss of each single bone of a skeleton; and at length, after finding leisure, strength and courage for all these operations, to look forward, as the fruit of one's labor, to the publication of unwelcome intelligence, opposed to the prepossessions of the scientific as well as to the unscientific public;—when these circumstances are taken into account, we need scarcely wonder that a passing traveler failed to

stop and scrutinize the evidence, but that a quarter of a century should have elapsed before even the neighboring professors of the University of Liège came forth to recognize and vindicate the truthfulness of their indefatigable countryman."

In 1841, M. Boucher de Perthes found flint implements in the valley of the Somme, France. These were associated in the terrace gravel (which was being removed for the fortifications of the place) with bones of the Elephant, Rhinoceros, Bear, Hyæna, Stag, Ox, Horse, and other animals. In 1847, he published an account of his researches in a work entitled, *Antiquités Celtiques.*

All of these discoveries were regarded as of little importance at the time, but later investigations have awakened a new interest, and the old fields have not only been re-examined, but others have been opened, which exhibit, it is thought, much stronger proof of the great antiquity of Man. The valley of the Somme, now historical in the annals of Archæology, which is about a mile wide and situated between Abbeville and Amiens, is of the Chalk formation, with horizontal strata. Bluffs, which are in some instances three hundred feet in height, bound the valley; from these heights a level plateau stretches out, the surface of which for about five feet in thickness consists of brick earth; this is destitute of fossils. Patches of sand and clay, with Eocene fossils, are occasionally seen, and it is probable that this formation once stretched continuously over the chalk, but has been broken up and removed by denudation; and these materials contribute largely to form those beds of gravel in which the flint implements and the Mammalian remains are entombed. The following particulars from Lyell's work will give a more complete exhibition of the subject:

SECTION ACROSS THE VALLEY OF THE SOMME.

"1. Peat, twenty to thirty feet thick, resting on gravel deposited on chalk (newest deposit.)

"2. Lower level gravel, forming the first bench, with Elephants' bones and flint tools, covered with fluviatile loam, twenty to forty feet thick.

"3. Upper level gravel, forming the second bench, with similar fossils, and with overlying loam, in all thirty feet thick.

"4. Upland loam, without shells, five or six feet thick, spread over the plateau, as before described.

"5. Eocene tertiary strata, resting on the chalk strata in patches."

The peat, as before stated, is the most recent of all these deposits, and occupies the lower parts of the valley, all the way from the sea to far above Amiens, including Abbeville, and in places is thirty feet thick. All of the imbedded Mammalia, as well as the shells, are the same species as those now inhabiting Europe. At some depth in this formation, near Abbeville, are seen trunks of alders standing erect as they grow, with their roots fixed in the ancient soil. Stems of the hazel, and nuts of the same, and trunks of the oak and walnut abound. Traced to the sea coast, the peat is seen passing under the sand-dunes and below the water level. This would indicate that there had been a submergence of the land, of what was once a continuance of the valley into what is now a part of the British Channel. The workmen who cut this peat declare that none of the hollows during their lives have been refilled, and, therefore, that peat does not grow; but this is a mistake, the increment in one generation not being appreciable to the ordinary observer. Near the surface of this deposit occur Gallo-Roman remains, and, still deeper, Celtic weapons of the Stone Period; but this is no sure test of age, for in a semi-fluid mass heavy weapons would sink down by their own gravity. In one case, however, M. Boucher de Perthes observed several larger dishes of broken pottery lying in a horizontal position, the shape of which must have prevented them from sinking through the underlying peat. Allowing about fourteen centuries for the growth of the superincumbent vegetable matter, he calculates that the thickness gained in a hundred years would be no more than three French centimetres, say about three English inches. This rate of increase would demand so many tens of thousands of years for the formation of the entire thickness of thirty feet, that we must hesitate before adopting it as a chronometric scale.

The materials making up the deposit No. 2 are almost devoid of stratification, and are probably formed of the mud or sediment thrown down by the waters of the river when they overflowed the ancient alluvial plain of that day. Its upper surface has been deeply furrowed by water, at the time when the earthy matter of No. 1 was superimposed. The Mammalia most frequently found in this deposit, as well as No. 3, are the following: *Elephas primigenius, Rhinoceros tichorhinus, Equus fossilis, Bos primigenius, Cervus somonensis, Cervus tarandus priscus, Hyæna spelæa.*

The deposit No. 3 is made up of a succession of beds, chiefly of a fresh-water origin, but occasionally a mixture of marine and fluviatile shells is observed. In the lowest beds of gravel and sand, in contact with the chalk, flint hatchets, some perfect, others much rolled, have been found. Above this bed occurs a white, silicious sand, in which are found the remains of numerous fresh-water shells now common to the region, except Cyrena fluviatilis, which has disappeared from Europe, but inhabits the Nile and many parts of Asia.

The flint implements found in this connection exhibit rude workmanship. The two prevailing forms are oval and pear-shaped. Their edges are more or less fractured or worn, either by use as instruments before they were buried in the gravel, or by being rolled in the river's bed. Many of them are stained ochreous-yellow, while others have acquired white or brown tints, according to the matrix in which they have been enclosed. The surface in many instances is encrusted with a film of carbonate of lime, while in others they exhibit those ramifying markings known as dendrites, which is a useful test of their antiquity. The most general test, however, is a varnish-like or vitreous gloss, as contrasted with the dull aspect of freshly-fractured flints, a condition that has received the name of *patina;* used, also, in Numismatic lore.

M. Lartet, after a close scrutiny of the bones sent to the Paris Museum for Cuvier's inspection, observed that some of them bore the evident marks of an instrument agreeing well with incisions such as a rude flint saw would produce. Among others mentioned as having been thus artificially cut, are those of the Rhinoceros tichorhinus, and the antler of the Cervus somonensis.

The evidence obtained by naturalists that some of the extinct Mammalia of this valley really lived and died in this part of France at the time of the imbedding of the flint tools in fluviatile strata, is most satisfactory; and not the less so for having been put on record long before any suspicion was entertained that works of art would ever be detected in the same beds. Thus M. Baillon, writing in 1834 to M. Ravin, says: "They begin to meet with fossil bones at the depth of ten or twelve feet in the sand-pits of the Somme, but they find a much greater quantity at the depth of eighteen and twenty feet. Some of them were evidently broken before they were imbedded; others are rounded, having, without doubt, been rolled by running water. It is at the bottom of the sand-pit that the most entire bones occur. Here they lie without having undergone friction or fracture, and seem to have been articulated together at the time when they were covered up. I found in one place a whole hind limb of a Rhinoceros, the bones of which were still in their usual relative position. They must have been joined together by ligaments, and even surrounded by muscles, at the time of their interment. The entire skeleton of the same species was lying at a short distance from the spot."

Prof. Noeggerath, of Bonn, informs us that about the year 1845, when the bed of the Rhine was deepened artificially, several flint hatchets were brought up by the dredge from the bed of the great river. Ascending the valley of the Somme from Abbeville to Amiens, a distance of twenty-five miles, we observe a repetition of all the same alluvial phenomena which we have seen elsewhere in this region, with the single exception of the absence of marine shells and of Cyrena fluviatilis. In both the lower and upper gravels, flint tools and the bones of extinct animals, together with river shells and land shells of living species, abound. A little below Amiens, at Montiers, in the gravel, were found some flint knives, one of them flat on one side, but the other carefully worked, and exhibiting many fractures, clearly produced by blows skilfully applied. Some of these knives were taken from so low a level as to satisfy us that this great bed of gravel at Montiers, as well as that of the contiguous quarries of St. Roch, which seems to be a continuation of the same deposit, may be referred to the Human Period. Dr. Rigollot had already mentioned flint hatchets as obtained by him from St. Roch, but as none have been found there of late years, his statement was thought to require confirmation. The discovery, therefore, of these flint knives in gravel of the same age was interesting, especially as many tusks of a Hippopotamus have been obtained from the gravel of St. Roch, some of these recently by Mr. Prestwick; while M. Garnier, of Amiens, has procured a fine Elephant's molar from the same pits, which Dr. Falconer refers to Elephas antiquus. Hence it is inferred that both these animals coexisted with Man.

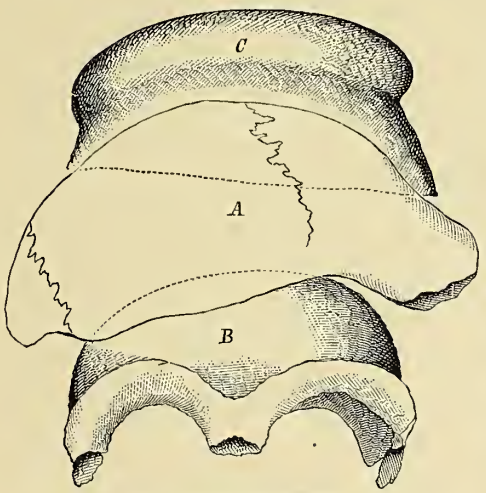
There is to be seen in the American Museum, New York, a collection of over three thousand objects in flint—implements in every stage of workmanship, from the rude *chip* to the beautifully polished and symmetrical celt or adze—nearly all obtained from the valley of the Somme. A map and sectional drawings show the locality and character of soil—immense chalk cliffs—from whence these curious relics have been taken. The chalk cliffs have furnished the material to our knowledge of the pre-historic Man, and in the gravelly drift that has accumulated over them, he, his associated beasts and implements have all found a mausoleum. A number of celts bear rude carvings, as representatives of the human figure, rings and crescents; all much in the manner of our juvenile slate-pencil artists. These ancient peoples seem to have had a fancy for all objects that bore any resemblance to the human face or form. There are many specimens in this collection which have been carefully polished and cut to preserve and heighten the supposed resemblance. These were undoubtedly household gods; or, possibly, may have been used as *wampum*, if we may borrow a term from the North American Indian. Among the choicest relics are beautifully-polished axes, set in Stag-horn and in long bones of domestic animals. Implements of the hardest nature are found, polished, and formed into beautiful shapes; Quartz-crystal, Jade and Porphyry are common. The subject of Archæology has heretofore received but little attention in America; it is therefore a matter of great interest that so much valuable material has been obtained.

The models of Swiss Lake Dwellings, and a large collection of stone and bone implements from the same locality, are most important additions, and are of great value to the student of this interesting department of science.

In 1857, in a cave near Dusseldorf, situated in the valley of the Neanderthal, and about seventy miles from the caverns of Liège, there was found a portion of a human skull that has become more familiar to the scientific world than others, in view of certain characters which stamp it as of an unusually low type. Other bones were found which were evidently portions of the same skeleton, but the workmen had so scattered them that only the long bones were preserved. Upon the surface of the cranium, both on the inner and the outer, were a profusion of dendritical crystallizations, and some other bones were similarly ornamented. The absolute and relative length of the long bones agree well with the dimensions of a European individual of like stature at the present day, but the thickness of the bones is regarded as very extraordinary. The elevation and depression for the attachment of muscles were developed in an unusual degree. Some of the ribs were of a singularly rounded shape and abrupt curvature. The remarkable depression of the forehead is not due to an artificial flattening, such as is seen in practice among the barbarous nations of

the Old and New World, the skull being quite symmetrical. On the whole, the skeleton is regarded as that of an individual of small cerebral development and uncommon strength of corporeal frame.

Fig. i.



The Neanderthal Skull.
A represents a side view, *B* showing a front view of the enormous ridges, and *C* the aspect of forehead from above.

Skulls taken from the tumuli of the Stone Period in Borreby, Denmark, resemble this of Neanderthal. One, particularly, has remarkably projecting superciliary ridges, a retreating forehead, a low, flattened vertex, and an occiput which shelves upward and forward.

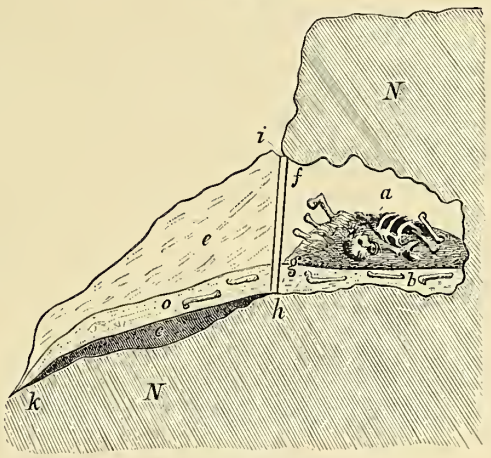
About the time that Schmerling was exploring the caverns of Liège, the Rev. Mr, M'Enery at Brixham, in Devonshire, England, found in a cave, in red loam, covered with stalagmite, bones of the Mammoth, Tichorrhine Rhinoceros, Cave Bear, and other Mammalia, and also several remarkable flint tools, which were regarded as of great antiquity. There were also remains of Man in the same cave, of a later date.

A discovery of much importance, as bearing on the subject of the antiquity of Man, is that made by Col. Wood, in 1861, of the remains of two species of Rhinoceros in an undisturbed deposit, in the lower part of which were some well-shaped flint knives, evidently of human workmanship. It is considered "clear, from their position, that Man was cœval with these two species of Rhinoceros."

In an interesting account of an ancient burial-place in Aurignac, in the south of France, Sir Chas. Lyell has given, with a sketch of the natural vault, a list of the animals whose remains were found associated with those of Man. We present here the most important portion of the descriptive matter, with sectional view of the place of sepulture.

"M. Lartet has recently published a circumstantial account of what seems clearly to have been a sepulchral vault of the Post-pliocene Period, near Aurignac, not far from the foot of the Pyrenees. Until the year 1852, the opening into this grotto was marked by a talus of small fragments of limestone and earthy matter Fig. ii. *e*, such as the rain may have washed down the slope of the hill *N*. In that year a laborer

Fig. ii.



The Cave of Aurignac.

observed that Rabbits burrowed at *i*, *f*. On reaching into the opening he drew out, to his surprise, one of the long bones of a human skeleton; and his curiosity being excited, he dug through, and eventually came to a large heavy slab of rock *f*, *h*, which stood vertically against the entrance. On the other side of this was an arched cavity, *a*, seven or eight feet in its greatest height, ten in width, and seven in horizontal depth. It was almost filled with bones, among which were two entire skulls, which were recognized at once as human. The mayor of the town ordered all the bones to be taken out and buried in the cemetery. There were, altogether, portions of seventeen distinct skeletons, of both sexes, and of all ages. The skulls were considerably injured in the transfer, and, some years after, when a renewed interest in the subject made it desirable to re-examine the relics, it was found that the sexton could not remember the exact spot of interment. Thus was lost to science a rich harvest of ethnological knowledge. M. Lartet made some explorations subsequently; he personally superintended this labor, and found, outside the grotto, resting on the sloping terrace *h*, *k*, a layer of ashes and charcoal, *c*, about seven inches thick, extending over an area of six or seven square yards, and going as far as the entrance of the grotto, and no further, there being no cinders or charcoal in the interior. Among the ashes, and in some overlying earthy layers, *o*, separating the ashes from the talus *e*, were a great variety of bones and implements; among the latter, not fewer than a hundred flint knives, projectiles, sling stones and chips, and among them one of those silicious cores or nuclei, with numerous facets, from which flint flakes or knives had been struck off, seeming to prove that some instruments were occasionally manufactured on the spot. Among the bone instruments were arrows without barbs, and other tools made of Reindeer-horn, and a bodkin formed out of the more compact horn of the Roe-deer.

"Scattered through the same ashes and earth were the bones of the various species of animals enumer-

ated in the subjoined list, with the exception of two—the Cave Lion and Sus scrofa (pig.) These latter were found within the grotto:—

I.—CARNIVORA.	Number of Individuals.
1. Ursus spelæus (*Cave Bear*)	5
2. Ursus arctos (*Brown Bear*)	1
3. Meles taxus (*Badger*)	1
4. Putorius vulgaris (*Pole Cat*)	1
5. Felis spelæa (*Cave Lion*)	1
6. Felis catus ferus (*Wild Cat*)	1
7. Hyæna spelæa (*Cave Hyœna*)	5
8. Canis lupus (*Wolf*)	3
9. Canis vulpes (*Fox*)	18

II.—HERBIVORA.	
1. Elephas primigenius (*Mammoth*)	
2. Rhinoceros tichorhinus (*Siberian Rhin's*)	1
3. Equus caballus, (*Horse*)	12
4. Sus scrofa (*Pig*)	
5. Equus asinus (*Ass*)	1
6. Cervus elephas (*Stag*)	1
7. Megaceros hibernicus (*Gigantic Irish Deer*)	1
8. C. capreolus (*Roe-buck*)	3
9. C. tarandus (*Reindeer*)	10
10. Bison europæus (*Aurochs*)	12

"If we accept M. Lartet's interpretation of these deposits of Aurignac, they do not add anything to the palæontological evidence in favor of Man's antiquity, for we have seen all the same Mammalia associated elsewhere with flint implements; and some species, such as Elephas antiquus, Rhinoceros hemitæchus and Hippopotamus major, missing here, have been met with in other places. An argument, however, having an opposite leaning, may perhaps be founded on the phenomena of Aurignac. It may, indeed it has been said that they imply that some of the extinct Mammalia survived nearly to our time.

"First, because of the modern style of the works of art at Aurignac. Secondly, because of the absence of any signs of change in the physical geography of the country since the cave was used as a place of sepulture."

In closing this portion of our subject, which relates particularly to European Anthropology, it is proper to add the remarks of Sir Chas. Lyell concerning the two most remarkable specimens of human remains thus far found in the Old World. He says:

"The two skulls which form the subject of the preceding comments and illustrations have given rise to nearly an equal amount of surprise, for opposite reasons: that of Engis, because, being so unequivocally ancient, it approached so near to the highest or Caucasian type; that of the Neanderthal, because, having no such decided claims to antiquity, it departs so widely from the normal standard of humanity. * * * * The expectation of always meeting with a lower type of human skull, the older the formation in which it occurs, is based on the theory of progressive development, and it may prove to be sound; nevertheless we must remember that, as yet, we have no distinct geological evidence that the appearance of what are called the inferior races of mankind has always preceded in chronological order that of the higher races."

AMERICAN RECORD OF MAN'S ANTIQUITY.

In America, a considerable number of discoveries have been made which tend to carry back the origin of the human race to the same period when the Mammoth and the Mastodon flourished, as seems so clearly indicated in the recent Archæology of the Old World.

In 1857, Dr. Winslow sent from California to the Boston Society of Natural History a fragment of a human skull which was found in the pay-dirt, associated with the bones of the Mastodon and Elephant, one hundred and eighty feet below the surface of Table Mountain. A human cranium was afterwards found in the same State, deeply buried in the gold-drift, and covered with five successive overflows of lava. Though this *find* was regarded with suspicion, Prof. Whitney, who obtained the specimen from the finder, decided, after a careful examination of the skull and its locality, that its history was a truthful one. It was found in a shaft one hundred and fifty feet deep, near Angelos, in Calaveras County. The shaft passed through five beds of lava and volcanic tufa, and four beds of auriferous gravel. This specimen was submitted for examination at the meeting of the American Association for the Advancement of Science, in Chicago, in 1869. From its position in this formation, the skull is regarded as older than the stone implements of the drift of Abbeville and Amiens, or the relics of the cave-dirt of Belgium and France. It is therefore considered by Prof. Whitney to belong to the Pliocene Epoch, a time prior to the volcanic eruptions which spread their lavas over a larger portion of the State. An instrument of stone was found imbedded in the gravel of the valley of San Joaquin, thirty feet below the surface, and the bones of the Mastodon and Elephant are found very frequently, associated with artificial implements at various depths, reaching to a hundred feet or more. Mr. W. P. Blake exhibited flint implements at the Paris Exposition which were found in the auriferous gravel of California.

On the island of Petit Anse, Louisiana, in a mine of rock-salt, a fragment of matting was found near the surface of the salt. About two feet above it were remains of bones and tusks of a fossil Elephant. This matting was formed of the outer bark of the Southern Cane (*Arundinaria macrosperma.*) The late Dr. Koch, of St. Louis, asserted that flint arrow heads and remains of charcoal were found in connection with the great skeleton of the Mastodon, which he forwarded to the British Museum. In this there seemed to be some evidence that the great creature had been attacked and destroyed while mired in the bed of the valley. Dr. Newberry says that many specimens that have come under his observation, showed signs of having been accidentally sunk in the mud, when the carcass was burnt by the setting fire of the peat. In another instance, on the Pomme-de-Terre River, Mo., one of the arrow heads lay underneath the thigh bone of the skeleton, the bone actually resting in contact upon it, so that it could not have been brought thither after the deposit of the bone, a fact which

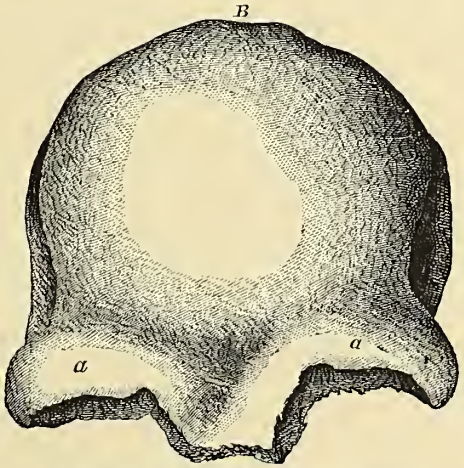
was carefully investigated. In July, 1859, Prof. Holmes, of Charleston, S. C., described in the pages of the *Proceedings of the Philadelphia Academy of Natural Sciences*, the occurrence of fragments of pottery, in connection with the bones of the Mastodon and Megatherium, on the banks of the Ashley River, S. C. The specimens of pottery, as well as the bones of the great Mammals, are now in the American Museum, Central Park, N. Y., and form a part of the valuable "Holmes Collection," lately purchased by the trustees of the Museum. The plain on which rests the city of New Orleans, says Dr. Dowler, rises only nine feet above the surface of the Gulf of Mexico. Excavations are made at times below this level, when successive forests of Cypress trees are exposed. When the foundations for the gas-works were laid, it had been necessary to cut through four of the buried forests. At a depth of sixteen feet the workmen found burnt wood and the skeleton of a Man, lying beneath the roots of a Cypress tree of the fourth forest level. The cranium was like that of the aboriginal American race. Cypress trees, ten feet in diameter, were found in the lowest forest level, beneath which these bones reposed. In 1848, Count Pourtales discerned a human jaw and other remains, in a fresh-water sandstone on the shore of Lake Monroe, Fla., associated with fresh-water shells of species still living in the lake. No date can be assigned to the formation of that deposit, from present observation at least.

At a time not far distant, our knowledge of these remarkable peoples, the mound-builders, was restricted to a very small number of facts, derived from the desultory searchings of the curious; and as no fairly scientific estimate had been brought to bear upon the few items of information thus derived, we had erroneously been led to believe that the few crania exhumed from the Western and Southern mounds, were nothing more than those of the existing race of Indian, or those of that type. The fact, also, that silver crosses and iron implements, which showed evidence of modern manufacture, were found in close contact with the human remains that were reported as exhumed from the mounds, had the effect to induce the belief, among some enquirers, that a higher state of civilization should be accorded the builders. On the other hand, it was an evidence to others that there had not existed any other people, save the present race of Red Men, and that the modern-built objects were obtained by the usual methods, many years since, when the Indians of the Eastern and Middle States came in contact with the Jesuit priests of Canada. No doubt a portion of the latter is quite true, and it is quite true that numerous crania of the present type of North American Indians have been exhumed from the various tumuli, both of the Southern States and those of the Western. It is also true, however, thanks to the industry of some of our *savans*, that crania of a wholly different type have been taken from the same source. We have had the privilege of the acquaintance and friendship of Dr. E. H. Davis, of New York, who, in company with Mr. Squier, published an exhaustive work on this subject, and have from him the result of his ripe experience. It is his own settled conviction, arrived at through extensive explorations made in the mounds of Ohio and other Western States, that these vast and fancifully-shaped tumuli were erected by a race closely related to, if not identically the same as, the Aztecs of Central America, and that the interior of these mounds hold, buried in state, the remains of important personages of their time. It will be seen, then, if we accept this hypothesis, that our present race of North American Indians have had nothing whatever to do with the origin of these works, but have used them as convenient places of burial, and, as Dr. Davis remarks: "The mounds were not regarded by them as anything more than natural hillocks."

The late Dr. William Stimpson, whose memory will be honored by every lover of Natural Science, for his name has great prominence on the roll of our American zöologists, was led to explore certain elevations near Chicago, that had long remained unrecognized as anything more than natural inequalities of the soil. Circular trenches, investing knolls two and a half feet above the surrounding plain, were found to be definite works of a by-gone race, resembling those already familiar to the inhabitants of Ohio and Wisconsin, except in size. Under Dr. Stimpson's direction these mounds were explored. Portions of eleven skeletons were found in the first group opened, but they were so far decayed that only one skull and three frontal bones were sufficiently well preserved to admit of measurement and comparison.

In Haas Park, near Chicago, Ills., mounds were found to contain several very remarkable human skeletons. Here, as well as in others, remains of individuals of the present Indian race were found, but always as recent burials, generally on the surface.

Fig. iii.



Skull from Kennicott's Mound, near Chicago.

By permission of Dr. Foster's publishers, we are enabled to present an illustration from his work on the *Pre-Historic Races of the United States*. Fig. iii is the frontal portion of the most perfect specimen of cranium that was found in the Chicago tumuli. The letters *a*, *a*, indicate the unusual development of

the superciliary ridges. Of a fragment of another, the author remarks: "It is undoubtedly the most remarkable hitherto observed. It is so far anomalous that I shall hereafter omit to compare it with existing types." Several other crania have been observed in the Western mounds which, by their small capacity and peculiar conformation, add materially to the evidence in favor of the relationship of the Aztees and kindred people of Mexico.

"The first pages of a work by MM. Quatrefages, entitled *Crania Ethnica*, are devoted to a consideration of the so-called fossil races of Man, which, however peculiar in their general character, the authors maintain to be still persistent in various parts of the world. This they call the *Canstadt Race*, from the fact that its first discovery was at Canstadt, in 1700, as the result of certain investigations undertaken by the Duke Ludwig, of Würtemburg. The importance of the specimen—a fragment of human remains—though it was figured by Jäger and Raas, has only recently been recognized, and it is brought forward prominently in this work. The essential characters of the Canstadt skulls, like those of Neanderthal, Engisheim and Denise, are a remarkable flattening of the cranial vault, a backward projection of the posterior region of the cranium, a development, sometimes enormous, of the frontal sinuses, and the very oblique direction of the forehead, the depression of the parietals in their postero-internal third, etc. These characteristics are very much reduced in the female sex. Thus, the superciliary ridges disappear almost entirely, the projection of the occipital is much less marked, but the flattening of the cranial vault, and some other characters, are persistent. The term Dolicho-platycephalic has been applied to this cranial type, so well marked is the aggregate of its characters. The authors consider the question of atavism, but are decidedly of opinion that this form of cranium is not at all incompatible with an intellectual development equal to that of a less exceptional condition."—*Baird.*

ORDER II.—QUADRUMANA.

THE Quadrumanes, or four-handed animals, having the hind limbs formed for grasping, like the anterior, are mostly confined to the inter-tropical regions. In two instances they are found without the limits. In Paraguay a species is known, and a late discovery locates an Old World form in Northern India. During the late Franco-Prussian War, Abbé ———, a French Jesuit, was traveling in India, and procured in Thibet several rare specimens of animals. Among them the abbé noticed a Monkey that is altogether new, and in this locality far out of the usual abode of the Quadrumanes. On reaching Europe he disposed of the prize to an agent of the American Museum, in Central Park, New York, where it now is. This places animals of this Order farther North than any have been known to exist heretofore. Two prineipal divisions are made in this Order: the Catarrhine Monkeys include those having the nostrils near each other; the term, being from the Greek, refers to this character. They are all Old World forms. Other characters are peculiar to them, as the callous development on the buttocks, or over the isehial portion of the pelvis; the skeleton shows a broad, flattened process at the extremities. There are curious pouches in the cheek, which are not seen in those of the New World Monkeys. It is this development of the cheek that enables the Catarrhine Monkey to fill his neck with food, as is seen sometimes to a ludicrous extent. The Anthropoid or Man-like Apes are at the head of this group, represented by the Gorilla, Chimpanzee, and Orang. The Platyrrhine Monkeys are all of the New World, and are characterized by having prehensile tails in most cases, and two extra teeth in each jaw, the whole number being thirty-six, the Catarrhines having only thirty-two. They are further distinguished by having no callosities on the ischium, and no cheek pouches.

FOSSIL QUADRUMANA.

The first fossil of the Quadrumanous form was found in the Himalayas, in 1836. It belongs to the genus Semnopithecus. A fossil tooth was unearthed in the Pliocene beds of Essex, England, which is closely allied to the Macacus sinicus. In 1839, Lund, who made extensive explorations in the bone caverns of Brazil, found the remains of a Monkey of great size, four feet in height, associated with bones of other animals. These were in the Pliocene of the limestone formation, in which so many large excavations are found. This was described as a new genus—Protopithecus. Remains of a small Monkey, closely allied to the Gibbons, were found by M. Lartet in the Miocene of the south of France.

A portion of the lower jaw, with teeth, and a shaft of a humerus of a Quadrumane, equaling in size those of Man, were discovered in St. Gaudens, France, in the upper Miocene. This form is nearly allied to the Gibbons, and has the generic title Dryopithecus. At a time when some government excavations were being made in Greece, there were found twenty skulls of Monkeys, with the jaws and other bones in such a condition that M. Gandray was enabled to make a drawing of the whole skeleton. This was named the Mesopithecus; having some features in common with the two genera, Semnopithecus and Macaeus.

Among the recent discoveries made by the naturalists of the U. S. Exploring Expeditions in Western North America, are remains of animals which indicate a close alliance with the Quadrumanes of the Old World. In Hayden's *Report of the Geological Survey of the Territories* (1872.) Prof. Cope says: "In the Proceedings of the American Philosophical Society, 1872, the writer described a species of Quadrumanous Mammal, under the name of Anaptomorphus æmulus,

comparing its dental and other characters with those of *Simia*. In the American Journal of Science and Art, for November, 1872, Prof. O. C. Marsh announced that he believed that three genera previously described by him, viz., Thinolestes, Limnotherium, and Telmatolestes, were referable to the Quadrumana, saying that they 'have the principal parts of the skeleton much as in some of the Lemurs.' Prior to either of these determinations, the author described a new genus and species, as allied to Notharctus (Leidy), under the name of Tomitherium, but made no suggestion as to its ordinal position. On re-examination of the last-named genus, I am satisfied that it should also be referred to the Quadrumana." Prof. Cope gives a description of the generic characters, and then adds: "We have, then, an animal with a long thigh free from the body, a fore-foot capable of complete pronation and supination, and a form of lower jaw and teeth quite similar to that of the lower Monkeys. The form of the humerus and its relative length to the femur are quite as in some of the Lemurs." The species is Tomitherium rostratum (Cope), and is judged to have been about the size of the prehensile-tailed Monkeys of South America. These remains were found near Church Buttes, Wyoming. Under the generic title Notharctus, Prof. Cope describes a species—N. longicaudus—"which probably associates characters of the lower Quadrumana with Cercoleptes and other types."

Anaptomorphus æmulus, previously mentioned, is described as a species about as large as a Marmoset, or Red Squirrel. "The dentition is more typically Quadrumanous in this genus than in the last, and it might be referred decidedly to Lemuridæ, were it not for the unossified symphysis. It no doubt represents a distinct group or family from Tomitherium, and one more nearly related to the existing types of Madagascar and South Africa."

FAMILY—CEBIDÆ.

In accordance with the system adopted by Gray in the British Museum, the Monkeys of the New World are arranged under nineteen genera, two of which are fossil, and extinct. These genera are all included in one Family—the *Cebidæ*—which is subdivided into numerous Tribes. This Family embraces all American Monkeys. The term *Cebus* or *Kebos* is from the Greek, simply meaning Monkey; there is, then, no special signification to the word, any more than there is to the term which is applied in a general way to the Old World Monkeys, the *Simiadæ* meaning the same.

The *Cebidæ*, as we have seen, differ in several important particulars from the *Simiadæ*. The presence of an extra number of molars, a broad and distinct nasal septum, the absence of cheek pouches and callosities are notable, as well as the fact that many of them have the tail most remarkably developed into an extra clasping member, which practically serves as a fifth hand, suiting most admirably their arboreal life. The thumb in these Monkeys is not completely opposable with the fingers, and in several instances is wholly absent. Curiously, there are cases where the thumb is developed more or less on one hand, and completely absent on the other. The forest regions of tropical America are the favorite localities of these Monkeys, their range extending from the southern portion of Mexico to about the thirtieth parallel of South latitude.

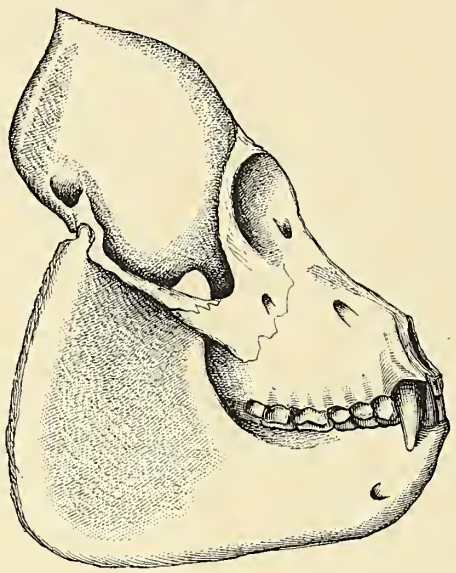
Monkeys of the New World are more numerous in species than any other form, spreading over a wide extent of country, some two thousand miles from East to West, and six to eight hundred from North to South. The conditions of life are similar in all this range, and furnish, particularly with the arboreal character, a secure and natural retreat for a class of animals that would be nearly helpless without them. The Howling Monkeys (Mycetes), and the Spider Monkeys (Ateles), are eminently of this group. The *Cebidæ* are not entirely dependent upon the friendly shelter of the forest; some, even, are adapted for a life upon the broad areas of broken hillocks. The most northern limit of the Quadrumanes on this Continent is now placed at a parallel of 23° North latitude, or the Tropic of Cancer. This is also the limit of the Quadrumana of the Old World, with the exception, noted previously, of the new Macaque from Northern Thibet. The geographical distribution of the South American Monkeys is sharply defined in many instances. There are none found, for example, west of the Andes until, in going northward, we reach Guayaquil. Tschudi describes twenty-two species as occurring in Peru, but he carefully defines the regions in which they are found. The whole number occur in the forest region east of the Cordilleras. In many instances the locality of South American Monkeys is given as Peru, simply; in these cases it is meant that the particular region lies *east* of the Cordilleras. A certain amount of isolation is produced by the great rivers; when there are no friendly trees upon which they may cross to interlacing branches, they seem to be restrained from passing the barrier. In the case of large rivers there is a marked difference in the distribution on each side respectively. A large number of the Family *Cebidæ* were at one time included in the group called *Hapalidæ*.

The *Cebidæ* are arranged as follows:

TRIBE I.—MYCETINA.

This tribe is characterized by a pyramidical head and an oblique face, a gibbous chin, and crop covered with long, rigid hairs. The canine teeth are large; the lower jaw very much dilated behind. The os hyoides is very large and spongy. The thumb is distinctly formed; claws are convex, and the tail very long. They are ferocious and noisy at night. Their food consists principally of leaves of trees, on which they constantly live. In the genus Mycetes the fingers are very long, the tail exceedingly strong, and the face and lower part of the body naked. A most remarkable feature in these Monkeys is the hollow bony vessel in the throat, which is formed by an enlargement of the hyoid bone; by this arrangement of the vocal organs the creature is enabled to produce a hideous howling noise. They are large and heavy, and possess complete prehensile tails. Their special range is from East Guatemala to Paraguay.

Fig. iv.



Skull of Howler.

THE BROWN HOWLER (*Mycetes seniculus*)—Plate 2, fig. 5, and described in vol i, p. 38—is one of a group having a most remarkable development of the hyoid bone and the under jaw, both increased in depth to allow of a peculiar formation of the vocal organs; their voice is thereby greatly increased in volume, and they have accordingly been called Howlers. Orton says, "They are gifted with a voice of tremendous power and volume, with which they make night and day hideous. Gangs of these large, howling creatures often entertained us with their terrific yells which, in the truthful language of Bates, increased tenfold the feeling of inhospitable wildness which the forest is calculated to inspire." He adds: "They are the only Monkeys which the natives have not succeeded in taming." They represent the Baboons of the Old World in facial angle (30°) and disposition, and the Gibbons in their yells and gregarious habits.

THE URSINE HOWLER (*Mycetes ursinus*)—called also the ARAGUATO—is one of the largest as well as most abundant of the Monkeys of the New World. In length they are nearly three feet; the tail somewhat exceeding that. The color of the fur is of a rich reddish-brown, reflecting a bright golden sheen when a strong light is thrown upon it. There is a heavy beard, consisting of long hairs, depending from the chin, and cheeks of a darker hue. It is impossible to conceive of the intensity of the howling voice of these creatures; they seem to delight in imitating the sounds of other animals, as that of the Jaguar. They are reputed to hold conversations, in which each seems striving to outdo the rest. The anatomical structure of the throat of these animals explains readily their great vocal power. The hyoid bone, a structure quite small in Man, is in the Howler much larger. In the human throat this bone supports the root of the tongue, and gives attachment to certain muscles of the neck. In the throat of the Howler it is developed into a drum-like organ, bony throughout, and communicating with the wind-pipe; thus, through this mechanism, the wonderful resonance is produced.

A singular method is pursued in catching these Monkeys. It is said that a certain nut of great size, emptied of its contents, leaves a narrow natural opening; in this is placed a quantity of sugar; the Monkey is just enabled to put his hand into the opening, but cannot withdraw it without leaving his prize—that is, he cannot take out a handful with his paw closed. It is stated to be a fact that their curiosity and acquisitiveness are so great, that they can be captured before they will relinquish their treasure, the weight and bulk of the nut so embarrasses them. The flesh of the Howler is eaten by the natives, but is not particularly esteemed, being quite dry.

BLACK AND YELLOW HOWLER (*Mycetes bicolor*).—The male has uniform rigid black hair, the sides of the loins varied with yellow; hairs of this part black, with a broad, sub-central, reddish-yellow band. Inhabits Brazil.

THE SILKY HOWLER (*Mycetes laniger*).—This species is of a reddish chestnut, with middle of back golden yellow; the hairs are elongate, very soft and silky, dark brown at the base; golden or chestnut at the tip, with a close under fur. The hair of the head is rather elongate. A variety is mentioned with the end of the tail a little paler. This species is from Columbia. Dr. Slack regards it as "undoubtedly the same as M. seniculus."

THE MANTLED HOWLER (*Mycetes palliatus*) is the Aluatta palliata of Slack (*Journal of Acad. Nat. Sciences, Philadelphia*, 1862.) It is a black-brown; the hairs of the middle of the back and upper part of the sides yellowish-brown, with black tips; of the lower, parts of the sides elongate, brownish-yellow forming a kind of mantle on each side, which gives it the specific distinction. It is found at Caraccas.

THE RED AND YELLOW HOWLER (*Mycetes auratus*) has a dark red, or chestnut-brown color, with back and sides golden yellow. The hairs are rather short and rigid, dark at the base. The beard is darker.

THE BLACK HOWLER (*Mycetes caraya*) is black, with rather elongate and rigid hair; the sides, especially at the loins, with a few interspersed reddish hairs. This is the male, and the M. niger of Prince Maximilian. The original of the latter is in the American Museum, Central Park, N. Y. It is also the Simia caraya of Humboldt, and inhabits Brazil.

THE GRAY-HANDED HOWLER (*Mycetes barbatus*) is black, with one-colored, rather rigid, moderately long hair. The hands, feet, inside of thighs, circumference of face and end of the tail, grayish. From Brazil.

THE YELLOW-HANDED HOWLER (*Mycetes beelzebul*) is black, with rather soft, uniform black or reddish hair, with a few interspersed brown hairs on the shoulders. The feet, upper line and tip of the tail, spot in front of the ear and on the knee, reddish-yellow. This is the Simia beelzebul of Linnæus, the M. rufimanus of Kuhl, and inhabits Brazil.

THE VILLOUS HOWLER (*Mycetes villosus*) is black, with very long and silky hairs, uniformly black on the cheeks and under the ears, brownish at the base. Habitat Brazil.

TRIBE II.—LAGOTRICHINA.

The Lagothrices are distinguished by a round head, perpendicular face, and small canine teeth. The hinder part of the lower jaw is but little dilated. They are slow and solemn in aspect, living in groups, and eating insects and fruit. The genus Ateles has a dry, hard and smooth fur. The cutting-teeth are large, unequal, the two middle ones very long and broad; the grinders are small and rounded. The thumb is rudimentary, or is absent altogether. The chin and throat are nearly bald. The hair of the head is directed forward.

The Spider Monkeys are characterized by their extremely long and slender limbs and tail. Their range is over the entire area which the family inhabits, being found on the west side of the equatorial Andes, and on the Pacific Coast of Guatemala.

The term Ateles signifies imperfect, and is applied to this group on account of the hands being thumbless, or nearly so. In some species the member is a rudimentary one.

THE RED-FACED SPIDER MONKEY (*Ateles paniscus*).—Plate 2, fig. 6. The *Cebidæ* are well represented by the Spider Monkeys, which have gained their appellation from their remarkably attenuated forms. The limbs are slender and singularly long, and the tail has quite the semblance as well as effectiveness of a fifth arm. The latter member is considerably longer than the body; its extremity upon the inner surface is soft and palm-like, devoid of hair, and is practically a very supple and sensitive finger. It is carried with exceeding grace as he advances, and is ever the *avant courier* of all his movements. One is constantly reminded of the Elephant's proboscis, so adroitly, invariably, does Ateles present this fifth clasping member to his work—we might with propriety say his *first* member—for no one can witness his progression without being impressed with the fact that the prehensile tail is the one important means to the peculiar locomotion required in arboreal life, so fully adapted is this feature to the conditions of its existence and habits. Its almost requisite element seems to be an unbroken forest; this it has in all the grandeur of immensity—the Brazilian and tropical belt of woodland, which extends nearly from ocean to ocean, the width of the Continent. Some of the marine Mammals would be but little more embarrassed out of their appropriate element, than the Spider Monkey deprived of the friendly branching trees.

We have taken our material, and figure for description, directly from life, from the specimens in the Zöological Collection at Central Park, New York. Here are two species the A. paniscus and A. belzebuth—representing the most slender of the group, and showing in perfection all their peculiar features.

During the time occupied in sketching these individuals, the male kept up an unceasing display of calisthenics; the female seemed annoyed at this much of the time, but occasionally, when rudely jerked from the floor by the long, upraised tail, which they invariably carry erect when walking, she would join in the gambols. She was soon wearied, however, and willingly returned to her accustomed seat. On the wire screen of the great cage they seemed to spread out like *Daddy-long-legs*, impressing us much as that insect does, with its strange, furtive movements. Now, one passes hand over hand along the horizontal bar, never omitting a convenient contact of the tail-tip, which clasps a similar bar above, and slides along its surface, as we lead our hand down a stair-rail, ready to grasp it in any emergency. A sudden caprice, and his body drops; suspended by the tail he swings to and fro, glancing aimlessly, in the manner of all monkeys—in short, looking altogether as if he was doubtful what to do next. In this moment of indecision, he suddenly entertains a notion that his mate needs stirring up; whereupon he drops upon the floor, instantly stands erect, extends his long arms high above

Fig. v.

Spider Monkey.

his head as a balance weight, and strides off more human-like, even, than the great Apes that are much nearer Man in the scale of being. The illustration here given—(fig. v.)—was taken from the living specimen, and represents the creature in the act of walking upright without the aid of support. They are not able to continue this position longer than a few seconds, always returning readily to the ground, or to any support that the *four* hands may grasp, illustrating thereby their completely Quadrumanous character. The Spider Monkey is credited with the faculty of robbing the nests of birds that build in fancied security in the hollows of decayed trees. Ateles introduces his tail into the aperture, grasps the egg with the sensitive, finger-like tip, and, somewhat in the *presto! change!!* manner of Joe Grimaldi, passes the morsel, with a flourish, to his mouth. The clasping power of the tail is retained even in death; Monkeys that have been shot while hanging by that member, remained suspended until decomposition loosened the firmly-set muscles sufficiently to allow the carcass to drop.

THE MARIMONDA (*Ateles belzebuth*) resembles the latter, but in color is much darker, being a dull black, uniformly, with no glossy lustre. On the back and top of the head it is of a dense dead black. Though mild and amiable to a fault this species, from its peculiarly sombre aspect, has received its rather dubious specific name. In captivity it is gentle, and really exhibits a species of affection for those that care for it, attaching itself strongly to certain persons to whom it may take a fancy, and as frequently showing dislike to others—though not viciously. This species walks precisely in the same manner as the other. They do not set the sole of either hand flat upon the ground, but, turning the hinder feet inwards, they walk upon the outer side. With all the species the proper position is on all-fours, and the forest branches are as essential to its condition as the web to the Spider. In their native forests, the Spider Monkeys may be seen often clinging together in bunches, looking ludicrously like so much fruit. Their tails are, of course, used to coil around each other, and travelers tell most remarkable stories of their crossing streams, uniting in one long string, by a close entwinement of tails and heads, and at last swinging themselves over the chasm. This is no doubt true in a degree.

CHAMECK (*A. chameck*).—This species is a native of Brazil, where it is quite common. Its thumb is partially produced, but has only a single joint, and no nail, the member seeming to be of no special use, as it cannot be opposed to the fingers.

The Chameck is a very gentle creature, and is susceptible of considerable cultivation; like its relatives, it is not so capricious of temper as the Old World Monkeys, and is safely handled in play by any one that tends it. Its length is twenty inches, the tail being two feet more. The fur is long and hairy, hanging gracefully in dense masses over the limbs and body. Its tail is curiously ornamented with the same flowing hair, excepting at its tip, which serves as its fifth finger. The color of the fur is an uniform black; the face is of a deep brown, as well as the ears, cheeks and chin. Its lips are thought to be somewhat mobile, but less so than those of the higher Apes.

THE BLACK-FACED SPIDER MONKEY (*Ateles ater*) is a Brazilian, with black body and face, a short crown of hair, and that on the forehead moderately long. The young are brown in color. It is the A. paniscus, variety cayennensis of Geoff.

THE BROWN-HEADED SPIDER MONKEY (*Ateles fusiceps*) is black, with rather long, shining, crisp hairs, the longer ones having indistinct brownish tips. The crown of the head is rusty brown, giving it a special character, which gives rise to its specific name. Its particular locality is not given.

BARTLETT'S SPIDER MONKEY (*Ateles bartlettii*).—Mr. Edward Bartlett, who made a tour of South America, says of the species: "I have what I consider as a new species of Spider Monkey. It has a straight, erect, golden-yellow crest, a white stripe on each side of the face; belly and inside flanks brownish-yellow; back black. I obtained it in the mountains. The Indians considered it a great prize." In the *Proceedings of the Zöological Society of London*, is a figure by Wolff, and description of this species by Dr. Gray. The latter has since adopted the specific name *variegatus*. It was found by Mr. Bartlett, in Eastern Peru, near Xeberos. He made a long journey in quest of it, having learned that such an one existed on the Rio Tigri, a small tributary of the Amazon. At the highest point of the mountains in that region he met with several, about eight or nine. He shot one, and the Indians brought down another with a poisoned dart. One was sent to the British Museum, and the other, much to his horror, was put upon the fire and singed for cooking before he could regain it. "They seem," he says, "to go about in small parties, passing the forest in rapid movements, feeding on berries, &c."

GRIZZLED SPIDER MONKEY (*Ateles grisescens*).—Dr. Sclater has named this, and Dr. Gray describes it in *Proc. Zöo. Soc., Lon.*, for 1865. The latter regards it as very like A. ater and A. paniscus, but is at once known by its silvery hairs, intermixed with the black ones, and the pale color of the under side of the tail. There is no approach to these characters, he says, in any of the specimens of the species in the British Museum. Its fur is moderately long, black, with many silvery-white hairs interspersed. The tail is black, with grayish on the underside. The hair of the forehead is moderately long. It has no thumb. Its habitat is not given, though it is probably Brazil.

HOODED SPIDER MONKEY (*Ateles cucculatus*).—The fur of this species is very long and flaccid, of a blackish-silvery gray; the crown and nape, the hands and feet, are black; the sides of the rump are blackish; the hair of the crown very long, forming a large hood, which expands over the eyebrows. The face is reddish, large, and the orbits are black. The color of the back is produced by an intermixture of very long, blackish, and gray hairs. The hairs of the crown, and the hands and feet, are short and black to the base. It has no thumb. Its particular habitat is not given.

THE CHUVA (*Ateles marginatus*).—This was described by Bennett in the *Pro. Zōo. Soc., Lon.*, for 1830, as A. frontalis, from a specimen living then in the gardens of the Society; since then, Dr. Gray calls it by the present specific title—after Kuhl and Geoff. It is a uniform black; its forehead and whiskers are white; the hair is moderately long; its face is flesh-colored, with black orbits. It has no thumb. Inhabits Brazil.

THE BROWN SPIDER MONKEY (*Ateles hybridus*).—This is a more northern species, being found in St. Juan, in Nicaragua. It is an ashy-gray, with blackish washings. The hair is very soft, rather curly, intermixed with some longer, stiffer, blackish hairs. The crown of the head, fore-arms, legs to the knees, and the greater part of the tail, black. The face is blackish, with thin white hair on the lips. It has no thumb. The eyebrows are black, and there are many elongate black hairs on the outside of the thighs. The inside of the thigh and of the arm, near the armpit, is grayish.

THE BRILLIANT SPIDER MONKEY (*Ateles ornatus*).—This is like the melanochir, with all the colors intensified. The forehead, and all of the upper part of the head and the outside of the arms and legs, are black. The sides and under parts of the body, and inside of upper arms and legs, red-brown.

BLACK-HANDED SPIDER MONKEY (*Ateles melanochir*) is a very common species of this singular genus. A series of figures of this form are presented in the *Proc. Zōo. Soc., Lon.*, for 1875, accompanied with notes by Mr. Sclater, who remarks that the present species exhibits great variations in color. They seem to vary between the form designated by Dr. Gray, A. ornatus, figured by Sclater in the same Society's proceedings for 1871, and the nearly uniform gray form, with black hands and feet, which Dr. Gray has called Ateles albifrons in his *Catalogue of Monkeys in the British Museum*. Sclater says: "All the light-gray specimens, with black hands and feet, are, so far as I can ascertain, from Nicaragua or Panama, and the dark form—Ateles ornatus—alone, as Mr. Salvin informs me, occurs on the Pacific Coast of Guatemala. I am inclined to think, therefore, that we have here to deal with a series of local forms of a 'not yet differentiated' species." The habitat of this Monkey is given as the West Coast of America.

WHITE-FRONTED SPIDER MONKEY (*Ateles albifrons*) differs from the pale varieties of A. melanochir, in the forehead being white, fringed below with the dark hairs of the eyebrow, and in the feet being red. It may be a variety only. It is of a pale gray-brown, with white forehead; the crown is a darker brown. The tail, outside of the limbs, feet and groin, are reddish. The knees, elbows and hands, black. The outer and hinder side of the fore-arm is a blackish wash; has no thumb. It inhabits South America.

THE LONG-HAIRED SPIDER MONKEY (*Ateles vellerosus*).—This is like the A. belzebuth, but the under side of the tail is black as the upper, the pale color of the insides of the arms does not come down so near the hands, and the fur is much longer, and spreads out in all directions on the head and body. It is blackish in color, with the loins rather browner. The head, outside of limbs, and the upper and lower part of tail, are black. The throat, chest, belly, and inside of the limbs, are grayish-white. The hair is long and flaccid. It has no thumb. Habitat Brazil.

BRACHYTELES.

This genus is characterized by a soft, silky fur. The lower jaw is moderately dilated behind. The hair of the head is turned backwards. It is distinguished by having the cutting-teeth equal, small; canines short; grinders very thick and quadrangular. The septum of the nose is rather narrow. Thumb is rudimentary, or wanting. The claws are compressed. Tail is very strong.

MIRIKI (*Brachyteles arachnoides*) is sometimes called MONO. This form has, as a characteristic, a thick, short, and furry pelt, pretty uniformly brown in color over the head, body and limbs, the paws being very much darker than the rest of the body. A peculiar arrangement of the hairs about the face gives the aspect of a moustache. Its fur is so extremely close, that hunters are accustomed to make use of it to cover their implements, as it completely sheds the rain. The Miriki has a more perfectly developed thumb than others of the family. Several varieties are mentioned, some with and others without a thumb. One with a rudimentary thumb is recorded by Prince Maximilian, and the specimen which he obtained in South America during his travels is in the American Museum, Central Park, N. Y. His label gives it as Ateles hypoxanthus. Curiously enough, there are cases where the thumb is absent on one hand, and present in a more or less rudimentary form in the other. The native names given by Slack are Mariki kupo and Macaco vernello. Slack, in *Proc. Phila. Acad. Sciences*, for 1862, says, "In the Magazine of M. Verreaux, of Paris, I found specimens having upon one hand the tubercle, and upon the other the nailed thumb; others with the tubercle upon one hand, but absent on the other." The present species is ashy-brown with flesh-colored face. The base of the tail and the vent are ferruginous. Genital organs, brown. The females are ashy. It inhabits Brazil.

LAGOTHRIX.

This comprises the group called Woolly Monkeys. They are rather larger and less active than the others. The forests of the Upper Amazon Valley, and the slopes of the Andes and Venezuela and Bolivia, are regions most frequented by them. Their hair is soft and woolly, and of a cinereous black color. The thumbs are well developed. Limbs are short, proportionately. The chin and crop are less hairy than others. The hair on the crown is short, and directed backwards. The lower jaw is not largely dilated behind. The nostrils are oblique and rather closely situated below. Spix, in his *South American Quadrumana*, gives this group the generic name Gastrimargus, from a notion of his that they were more voracious than any other of the order on this continent. Slack remarks that the skull of this genus can be

readily recognized as distinguished from that of Sapajou or Brachyteles by the mode of articulation of the nasal bones with the intermaxillaries. In the Sapajous, no true articulation can be said to take place.

In Brachyteles and Lagothrix a broad, well-marked articulation takes place. The rami of the lower jaw are much broader than in either of the before-mentioned genera, approaching in size and form those of the Howlers. Gray records as generic traits that they are "slow, gregarious, meek, and often walk on their hind legs."

Fig. vi.

Humboldt's Monkey.

HUMBOLDT'S LAGOTHRIX (*Lagothrix humboldtii*) called, also, the GRAY CAPPARO.—The Upper Amazon is the favorite abiding-place of this Monkey, which is one of the largest of the American species; stout of limb, with a dense, black coat of fur, which reaches to the tip of his prehensile tail, and forms a deep, thick-set diadem around its head. Its fur is used extensively in commerce. A fine series of specimens of this Monkey is in the American Museum, Central Park, N. Y., showing the male, female and several young in various stages of growth. It is an interesting fact in this connection that so valuable a collection of Monkeys is accessible to the student. This is the largest series of prepared specimens on this continent, comprising equally numerous species in the two divisions of Old and New World. The types, and all the specimens gathered by Prince Maximilian of Neuweid, are there, and a choice collection, also, from Verreaux's, in Paris. The present species is a blackish-gray; the hairs individually are dark gray, with very short black tips. The head, chest, belly, hands and tail are black. The hair on the belly is rather longer. The young are quite a uniform gray.

This is the Gastrimargus olivaceus of Spix, Simia lagotricha of Humboldt, and L. capparo of Lesson. It inhabits Peru, mouth of the Orinoco, and Columbia.

THE REDDISH CAPPARO (*Lagothrix infumatus*) is a large Monkey found on the rivers Ycayali and Huallaga, and over the whole valley of the Peruvian Amazons. It is very common in the forests of the low country, generally in pairs; sometimes four or six pairs are seen occupying the same trees. The Mycetes suffer them to associate with them. These Monkeys are in great request for food, and, being very abundant, are extensively used. Bates speaks of a large specimen of this genus that he sent to the British Museum, which measured twenty-seven inches in length, the tail being twenty-six more. A Black Howler measured twenty-eight inches. The skin of the face in these Monkeys resembles that of an old negro. The Tacuna Indians eat them, and it is calculated that the tribe of two hundred persons destroyed twelve hundred of them annually for food. In captivity, it is much like the Spider Monkey—grave and confiding. It is not hardy, and seldom survives removal from its haunts.

The Reddish Capparo is a dark reddish-gray. The hairs are reddish, with black tips. The head and hands are rather darker. The inside of the fore-arms, chest and belly, is black; the groin, base of the tail and the sides, are redder. The hair on the chest and belly is abundant, long and rather rigid. It inhabits Brazil.

TRIBE III.—CEBINA.

In this tribe the grinders are $\frac{6}{6}$ $\frac{6}{6}$, with blunt tubercles. The cutting-teeth are erect and contiguous to the canines. The canine teeth are very large. The orbits have a bony septum. The tail is very long and hairy, and has the end convolute. The penis has an expanded marginal gland. Gray, in describing them, says they are "gregarious, lively and wanton," living on fruit and insects.

CEBUS.

The Cebi have round and hairy tails, which, though prehensile to a considerable extent, is not depended on for locomotion. Some are, therefore, found away from the forests, being adapted for a life upon the rocks and precipitous mountain ridges.

This genus is divided by two distinctions, C. fatuellus, robustus, and monachus, having five lumbar vertebræ, and a large head, and the remaining species having six lumbar vertebræ, with small head.

SAI (*Cebus capucinus*), also called the WEEPER.—The Brazils form the natural habitat of the Capucins, so-called; this latter term seems to have arisen from the curious monk-like aspect of many of the species, particularly about the head. These Monkeys are quite intelligent, sprightly, and have curious, quaint motions that render them always attractive. Their food is of a mixed character, feeding on insects and vegetables; they will also eat eggs, robbing nests for the purpose, and will not overlook even the feathered kind upon occasion.

THE BROWN CAPUCHIN (*Cebus fatuellus*)—Plate 2, fig. 7—is sometimes called the HORNED MONKEY, and is a fair representative of the genus called, sometimes, Sapajous. They are reputed to be the most mischievous of the Monkey tribe. They have the tails covered by hair, and differ from others in not having them prehensile. From their plaintive cry, the term Weepers has been applied to each of the group. They are very mild and gentle, and easily tamed. The present species is characterized by an erect fringe

of hair which stands out from the forehead; this divides, and presents an appearance of two horn-like projections, which gives the specific name. These horns do not appear until maturity. The fur is mostly a deep brown or chestnut, with a tinge of red. The crest is grayish.

WHITE-CHEEKED CEBUS (*Cebus leucogenys*) is blackish, with soft, elongate, silky hair, and a thick under-fur. The hair of the head is shorter, and that of the face is reflexed. The cheek and temples are whitish-yellow, giving rise to its specific name.

THE APELLA (*Cebus apella*).—This is regarded as a very variable species. Its fur is thick, harsh, of a reddish-brown color, darker on the middle of the back, tail and legs. The fore-arms, whiskers and crown, black or blackish. The front of shoulders is paler, or yellow. The crown spot is broad, and often produced into longitudinal crests, somewhat elongated. A variety has pale yellowish fur, with yellow whiskers. This is the Simia apella of Linnæus, S. cornu of Buffon, and C. macrocephalus, or Big-headed Cebus of Spix.

THE SLENDER CEBUS (*Cebus pallidus*) has the crown patch on the back of the head small and blackish or brown in color. A small, short crest is observable in some on each side. The fur is soft, grayish fulvous; the limbs and tail of a darker brown. The beard is golden-yellow. It is the C. gracilis of Spix. Inhabits Bolivia. Two other varieties are recorded, the C. barbatus, Geoff, and C. flavus, Geoff —the latter the Simia flava of Schreb. An albino variety is named C. fulvus, by D'Orbigny, from Bolivia.

THE TUFTED CEBUS (*Cebus cirrifer*).—The fur of this is short, close, black. The face, chin, cheeks, sides of forehead, and narrow band over the eyebrow, yellowish-white, with interspersed blackish hairs. The hair of the head is reversed, sometimes erected into two long tufts that are directed backwards.

THE THICK-FURRED CEBUS (*Cebus vellerosus*).—The fur in this species is very thick, elongated, and is of a blackish-brown, with long, shining hairs. The top of the head, nape and whiskers, are black. The limbs and tail are blackish. The spot on the head is black and narrow, coming to a point in two erect pencils. Lord Stuart de Rothsay procured this in Brazil. It is said to differ from most Cebi in the front of the shoulders being like the back.

THE MONK CEBUS (*Cebus Xanthocephalus*).—In this species the hair is short, stiff, varied with black and yellow in color. The crown, temple, whiskers, chin, shoulders, haunches, arms, legs and tail, black. The back and sides are yellow, with more or less of black washing. Sides of neck, chest and front of shoulders, yellow. The hair of the crown is reflexed, and short. The forehead and temples are whitish-yellow. Two varieties are mentioned. This is the C. cucculatus of Spix. Its habitat is Paraguay and Rio Janeiro.

WHITE-FRONTED CEBUS (*Cebus albifrons*).—A pale reddish-brown, with back and outside of the limbs, redder. The face, forehead, throat, shoulders and chest, white. The tail has rather long hair. The hair on the crown is short.

THE WHITE-THROATED CEBUS (*Cebus hypoleucus*) is black, with the forehead, front of crown, neck and sides of the head, white; shoulders and chest the same. The face is a pale-flesh color. This is the Sai à gorge blanche of Buffon, and Simia hypoleuca of Humboldt. It is one of the most common species that we see in the menageries. It inhabits Central America, Guiana, and Carracas.

THE WHITE-HEADED CEBUS (*Cebus leucocephalus*) has fur of a dark reddish-brown, and obscurely punctulated. Head to the front edge of ears, white. The crown has a short, narrow, central black streak. The feet are blackish. Habitat Columbia. A variety, C. versicolor, is mentioned.

THE PALE CEBUS (*Cebus flavescens*) has fur nearly uniformly pale-yellow fulvous. The cheeks, whiskers and hair under the throat, grayish. The crown, nape, and middle of the back are darker; outside of the legs, redder. The hair of the top of the head and nape is elongated, and directed backwards. This is the C. unicolor of Spix. Inhabits Brazil.

CRESTED CEBUS (*Cebus robustus*).—The fur of this species is bright red in color. The limbs and tail are blackish. The crown is black. Some varieties are noticed. Habitat Brazil.

THE GRIZZLED SAPAJOU (*Cebus annellatus*) has brown fur, with reddish washings, especially on the thighs. The hairs have several pale rings. The hair of the crown is short, reflexed, forming a long, compressed, central longitudinal crest. Streaks on the side of neck, bent down on front of the shoulders, yellow. The belly is reddish. The crown, temple, whiskers, arms and legs, within and without, and the tail, black. The face has deep black hairs. The crown spot is broad, with a broad line to the forehead, and another on each side of the whiskers. No special locality is given.

GOLDEN-HANDED SAPAJOU (*Cebus chrysopus*).—The face, throat, chest, and front of shoulders, pale gray-brown; the back of head and eyebrows darker, and blackish. The fur is a pale sooty-brown, washed with golden. The outside of limbs is a golden fulvous. The hair is soft. Spix's C. unicolor is considered by some authors to be this species. Habitat Columbia.

THE BONNET SAPAJOU (*Cebus subcristatus*).—Its fur is blackish-brown; the outside of legs are yellowish washed. The sides of the face are pale ashy. The front of the shoulders and the upper arms, yellowish. The toes and fingers are elongate, and very slender. Hair of the crown is elongate, and divided by a central line, diverging to the eyebrows, and forming an erect transverse crest behind them. A variety has the frontal crest not so distinct, the toes being shorter. No special locality is given.

THE CAPPED CEBUS (*Cebus capillatus*).—In this the hairs of the crown are elongate, diverging in all directions. The fur is elongate, of a brown color, slightly washed with yellow, especially on the thighs. The sides of the forehead are grayer. The sides of the neck, and outsides of the shoulders and arms, fulvous. The crown and nape are blackish. Habitat Brazil.

TRIBE IV.—CALLITRICHINA.

This tribe includes forms that have the molar teeth $\frac{6}{6}$, with blunt tubercles. The canines are moderately long. The cutting-teeth are erect, in a regular series with the canines. The head is rounded. The lower jaw dilated behind. Eyes are moderate in size. Their habits are diurnal. The nostrils are situated far apart, laterally, and the tail is very long, lax and straight. The term Callithrix, which means "beautiful hair," is applied to several species in this tribe from their having a remarkably fine fur.

CHRYSOTHRIX.

This genus indicates by its name, that some of the species are golden in color. The fur is soft, close, erect. The tail is cylindrical, elongate, and covered with short hair; the end being rather tufted, and slightly prehensile. The septum of the nose is very broad. The lower jaw narrow behind. The eyes and ears are large. The skull is very much elongated, and very large behind. The septum of the orbit is membraneous. Spinous processes of the lumbar vertebræ are trapezoid.

The Monkeys of this genus are called Squirrel Monkeys on account of their peculiar movements and slender forms. They are gentle, timid, yet active little creatures. They are found in the tropical forests from Costa Rica to Bolivia.

THE TEE-TEE (*Chrysothrix sciureus*)—Plate 3, fig. 8.—These little Monkeys are characterized by a coat of extreme beauty. The specific name of the present one is derived from the resemblance of the kind to a Squirrel; its general appearance and habits reminding one of the latter. The Tee-tee is found in great numbers in Brazil, where it is called Saimiri. It is long and slender in body, with a tail equally so, that is about ten inches. The latter is more like that of a Rat than the usual form of its race. The intelligence of this little creature is quite surprising; this, with its extremely gentle disposition, and almost entire freedom from bad habits, renders it a favorite pet. It has a curious habit of watching the lips of persons who speak to it, as if it strove to understand what is said. The fur of the Tee-tee is of a rich olive tint, with golden reflections. The ears are white; the under surface a whitish gray; the tip of the tail black. Two varieties of the Tee-tee are mentioned: one with the back gray-punctated, and another with the back washed with golden yellow.

THE SHORT-TAILED TEE-TEE (*Chrysothrix ustus*) has gray fur, minutely punctated with black. The back is golden-washed, the hairs being a pale reddish-yellow, with minute black tips. The outer sides of the fore-arms are like the rest of the body. The tail is short, thick, and black-tipped. The face is whitish. One variety has the outer side of the fore-arm golden; while another has the same part of the fore-arm colored like the rest of the body.

THE BLACK-HEADED TEE-TEE (*Chrysothrix entomophagus*).—The fur is golden brown. The hairs of the back black, with long, yellow tips. The outer side of the thighs and shoulders closely punctated with black. The upper part, and the head and tail, black. The face, throat and inside of thighs, yellowish-gray. The ears are hairy, and the tail moderately long. A variety has the upper part of the head yellowish, with more or less long black tips to the hair, making the fur more or less deep black. Habitat of both, Bolivia. This and C. ustus are larger than C. sciureus.

CALLITHRIX.

This genus is characterized by having the tail covered with short hairs; septum of the nose nearly as broad as the cutting-teeth; ears large. Spinous processes of lumbar vertebræ acute, triangular, nearly incumbent. They are diurnal in habit, gregarious, lively, agile, living on fruit, insects and birds' eggs.

THE RED TEE-TEE (*Callithrix cuprea*) is dark black and gray-grizzled. Its cheek, throat, hands, feet, legs and under side of body, dark red bay. The tail is like the back, but rather darker. The hairs of the tail are dark gray, with a broad, subterminal black band. The eyebrows are black. A variety has white at the end of the tail. Habitat Brazil.

THE WHITE-CHESTED TEE-TEE (*Callithrix amictus*).—The back is reddish-washed, the hairs being black at the base. On the chest is a pure white spot. Hands are white; feet are black; forehead and tail black; hairs of the tail black at the base. It is the Simia amieta of Humboldt. Habitat Guiana.

THE COLLARED TEE-TEE (*Callithrix torquatus*) is a dark reddish-brown; the hairs are red below, with black tips; dark crown; the narrow margin to the face, white; hands, white; feet and tail, black; the hair of the latter red at the lower part; the forehead is black. Habitat Brazil.

THE REED TEE-TEE (*Callithrix donacophilus*).—The fur of this species is a pale gray, or reddish-black gray. The chest and belly, gray or reddish-gray; the tail, pale; hairs of the tail gray, with dark tips. The hands and feet are gray, like the back. Three varieties are mentioned. Habitat Bolivia.

THE ORABASSU (*Callithrix moloch*).—The fur is dark gray, black and red-grizzled. The cheeks, chest and belly are red. The hands and feet are dark gray. Inhabits Brazil.

THE BRIGHT ORABASSU (*Callithrix ornatus*) is black and gray-grizzled; its forehead and ears are white; its temples, cheeks, throat, under side of body, and inner side of legs, bright red chestnut. The hands and feet are gray; the tail, blackish-gray washed. The hairs of the tail are pale, with a broad subterminal ring. Inhabits New Grenada. Verreaux has described it as C. discolor.

THE MASKED TEE-TEE (*Callithrix personatus*).—The fur is black-grizzled; the hairs are long and blackish, with narrow gray rings. The chest and beneath, blackish-ashy; forehead, cheeks, whiskers, hands, feet and lower part of the legs, black; tail, blackish-ashy; hair near the base, reddish; of the lower half of the end, one-colored gray. Two varieties are noted. Found in Brazil by Lord Stuart de Rothsay.

THE BLACK-FRONTED TEE-TEE (*Callithrix nigrifrons*) has a bristly fur, gray colored, washed with black. The forehead, ears, spot on each side of the neck, hands and feet, inside of fore-arms and leg, black; chin, blackish; back of crown and nape, whitish-gray. The tail is reddish, the hairs of which are red to the base. The young are similar. Found by Lord de Rothsay in Brazil.

THE RED-BELLIED TEE-TEE (*Callithrix castaneoventris*).—The fur is dark blackish-gray, minutely annulated with gray. Outside of the limbs, reddish-washed; forehead, hands and feet, black. The whiskers, throat and chest, belly and inside of limbs, dark red chestnut. Tail is black, with tip whitish-washed. Hairs of the tail black to the base. Habitat Brazil.

BLACK-HANDED TEE-TEE (*Callithrix melanochir*). The crown, throat and inside of the limbs are black, and gray and black, mixed. A variety has the tail bright red. Another has less red in the fur. It inhabits the province of Bahia, Brazil.

THE GRAY TEE-TEE (*Callithrix gigo*).—The crown is nearly all black, slightly gray-dotted. The sides of the face, gular band and inside of the limbs are black. A variety has the throat whitish. It is called by Spix, C. cinerescens.

TRIBE V.—NYCTIPITHECINA.

Molars in this tribe are $\frac{6}{6}$ $\frac{6}{6}$. The incisors are vertical, in a regular series with the canines. The lower jaw is dilated behind. Eyes are large, and nocturnal. Nostrils are small, close together, as in the Old World Monkeys.

NYCTIPITHECUS.

The eyes in this genus are very large and lateral. The hair of the orbit is arranged like the face of an Owl. The septum of the nose is narrow. The ears are large; the claws small and weak. The spinous processes of the lumbar vertebræ are acutely triangular and incumbent.

THE DOUROUCOULI (*Nyctipithecus trivirgatus*).—The term Nyctipithecus in this group refers to their nocturnal habits, meaning literally, Night-Monkey. The present species is the one most known. It sleeps during the day, drawn up like a hybernating animal, and sallies forth at dusk to capture and feed on insects and the smaller animals within reach. Its large eyes enable it to see very distinctly at night. On the head there are three very distinct black lines, which radiate from each other; this has given rise to the specific name trivirgatus, or three-striped.

The fur is short. The color of throat and inside of limbs, grayish-ash; the chest and belly are ferruginous. The tail is slender, cylindrical, of a blackish-brown, with a yellowish-brown at the under part of base. This is the N. vociferans of Spix, and Simia of Humboldt. Its habitat is recorded as Peru.

THE VITŒ (*Nyctipithecus commersonii*).—This species has black facial streaks, irregular, and confusedly marked. The side ones are linear in shape; the middle one, broad and lozenge-shaped; frontal spots are short and white. The fur is rather long and thick. The color of the neck, chest, belly and inner parts of base of limbs and tail, fulvous. Tail is cylindrical in form. It is the N. felinus of Spix, Nocthora of Cuvier, Chirogaleus of Vigors, and Callithrix infulatus of Licht and Kuhl.

BROAD-TAILED VITŒ (*Nyctipithecus lemurinus*). The tail of this species is quite peculiar, spreading like that of a Squirrel; it is depressed and broad. There is a rounded, white spot over each eye. The frontal streaks are indistinct. The fur of the body and tail, elongate. Azara records that this Monkey is found in the Andes of New Grenada, at an elevation of four or five thousand feet above the sea, and that they make the woods resound with their clamorous cries of *dūrūcŭli*. These creatures are called by some Owl-faced Night Apes, from their broad radiate faces and large eyes. By the Indians they are designated *Ei-á*. Bates saw them tamed in Brazil, and says that they utter a hoarse cry, like the suppressed barking of a Dog. Their habitat is in the neighborhood of Bogota, Colombia.

TRIBE VI.—PITHECINA.

The molars are in this tribe $\frac{6}{6}$ $\frac{6}{6}$. The incisors on the lower jaw are large, inclining forward, converging, and separated from the canines by a space. The lower jaw is not dilated behind. The fur is harsh and elongate. The claws are bent; and the nostrils are far apart.

PITHECIA.

This genus is characterized by having the chin clothed with a heavy beard, the crown with a radiated, divided wig. The head and limbs are short. Tail long, and covered with long hair. The septum of the nose is broader than the incisors. In habits they are slow, sad, voracious, vociferous and gregarious. This is Brachyurus of Spix, and Yarkea of Lesson.

THE BLACK YARKE (*Pithecia leucocephala*).—The specific name of this indicates white-head, and the individuals bear it out in a degree. Gray says the forehead is yellow when fresh, and white when exposed and faded. M. Geoffroy thinks the color depends on the size of the specimen.

It is an elegant creature in form, and is singularly decorated in the female, by a thick and long fringe of white hairs around the head; the male has the same, but shorter. The top of the head is a deep black. There are such differences between the male and female as have led naturalists to suppose they were separate species. On the hairs of the female there are distinct rings, of a rusty-brown color, which give the whole body of fur a mottled appearance. The hair of the male has none. The food of these creatures is said to be wild bees, and their comb, which they capture with much adroitness. Their long hairy covering probably renders them invulnerable from the stings of the bees. They are called Fox-tailed Monkeys, on account of the beautiful Fox-like tail of some species; the latter quite in contrast with the stub tails of the Cacajao. The body and tail of the Black Yarke is of a dark brown color;

under the chin and throat the hair is almost entirely absent, the skin being of an orange hue. It is the Simia leucocephala of several naturalists; the Simia pithecia of Schreb, Pithecia ochrocephala of Kuhl, P. chrysocephala of Geoff, P. inusta of Spix and Saki of Buffon. Habitat Brazil.

THE YARKE (*Pithecia monachus*) has black fur, with gray washings; the hairs are very long, harsh, with white tips. The forehead and crown of the male is yellow; of the female is white. The specimen figured by Gray, in the *Voyage of the Sulphur*, has the face quite bald. This is the Yarque of Buffon, Simia monachus of Humboldt, P. hirsuta of Spix, P. quapa of Poeppig, P. nocturna of Lesson and P. irrorata of Gray. Habitat Brazil.

THE WHITISH YARKE (*Pithecia albicans*).—The fur is yellowish-white; tail, and large patch on the back, black, slightly washed with white; the hairs with short white tips. The sexes and young are similar. Bates gives the locality of this as Lake Tefle and the Upper Amazons.

THE WHISKER YARKE (*Pithęcia rufiventer*) is grayish-black, with pale washings. The hairs are rather soft, with a subterminal yellowish ring. The forehead is like the back, with moderately elongated hairs; the moustache is yellow; the belly, red. In the young the moustache is white, and the under surface gray. This is the Sagouin of Buffon, Simia pithecia of Linnæus, Fox-tailed Monkey of some, P. rufibarba of Kuhl, P. capillamentosa of Spix, and P. pogonias of Gray.

Tribe VII.—BRACHYURINA

In this tribe there are molars as follows: $\frac{6}{6}$ $\frac{6}{6}$. The incisors on the lower jaw are long, shelving and converging, as in the preceding, and separated from the canine teeth by a space. The lower jaw is dilated behind; the nostrils far apart. The fur is soft and silky. The claws are blunt.

Chiropotes.

This genus has the fur soft and short; the tail as long as the body, thick, and club-shaped. The crown is covered with hair in the shape of a wig, divided by a central longitudinal line. The chin is large, bearded on each side. The lower incisors are rather shelving. Limbs are strong, and short. Chiropotes is Lesson's, also Cacajao. Spix calls it Brachyurus, and Geoff. Pithecia. Chiropotes, made up from two Greek words, meaning hand, and to drink, refers to the habit of the members of this genus to pull away their beards and drink from the other hand, which they dip into the water for that purpose.

CUXIO, OR BEARDED SAKI (*Chiropotes sagulata*). Certainly this creature gets its former specific name *Satanus*, fairly, if its looks belie it not. Its coat is of an uniform brownish-black; and a peculiar confirmation of beard, produced by a group of hairs which start forward from the sides of the jaw and chin, gives to the creature a truly satanic expression. The beard is exceedingly long, full and heavy, and of the deepest black. Cuxio is said to be particularly fastidious concerning it, and to hold it aside with its paw when it drinks; indeed, it is said to drink differently from other animals—holding its beard away with one hand, and passing water to its mouth with the palm of the other. In the collections of the American Museum, in Central Park, N. Y., are several fine specimens of this Monkey, notably a male and female. They

Fig. vii.

The Bearded Saki.

attract especial attention for their rich black fur, and for their beautiful long pompon-like tails. Humboldt relates of this Monkey that, when enraged, it has driven its sharp teeth deeply into a thick plank. When out of temper it grinds its teeth, and leaps about, grinning, and exhibiting extraordinary mobility in the muscles of its face. It lives alone, or with its mate, differing essentially in this habit from other South American Monkeys. Its cry is strong, and resonant, reaching far into the depths of the forest. Being nocturnal in its habits, this capacity for discordant vocalizing renders it anything but a desirable neighbor; approaching in some degree the unearthly cry of the Howling Monkeys. This is the Simia chiropotes of Humboldt, P. chiropotes of Geoffroy, Simia sagulata of Traill, and Brachyurus satanus of Gray. The habitat is given as Orinoco, Demerara, and Guiana.

BROWN CUXIO (*Chiropotes satanus*).—This is characterized by an ashy-brown fur; face, crown, beard, limbs and tail, densely hairy; hairs elongate; chin-beard moderate in size and length. In the Paris Museum, the male specimen has the back brown, and the wig black; the female having the back and the wig fulvous. The young are nearly uniform brown, and the wig slightly developed. This is the Brachyurus israelita of Spix, and Chiropota couxio of Lesson. Inhabits Brazil.

THE BLACK CUXIO (*Chiropotes ater*) has the fur a jet black, and shining. The hairs of the eyebrows project forward unusually. In the young the fur is black, with very short, pale tips to some of the hairs on the back. The hair of the crown radiates from the centre, and projects forward. The beard is rudimentary. The tail is slender, as long as the body and head. Inhabits Brazil.

THE WHITE-NOSED CUXIO (*Chiropotes albinasa*). A single young specimen of this in the Paris Museum, from Brazil, has the fur of the body and head deep black, pale washed, with white nose. It is the Pithecia albinasa of Geoffroy.

OUAKARIA.

In this genus the fur is short and silky. The face is subcylindrical. The crown and forehead have short hairs directed forwards. There is very little beard. The legs are elongate. Lower jaw is dilated behind. The incisors of the lower jaw are very shelving. This is the Brachyurus of Geoffroy and Spix, Cacajao of Lesson. Gray remarks that the converging, slender, shelving, lower cutting-teeth, the slender limbs and the short tail show some affinity with Indrus of the Lemurs.

Fig. viii.

The Cacajao.

THE CACAJAO (*Ouakaria melanocephala*) is one of several curious forms, which are distinguished by having the incisor teeth oblique and proclive, and a short tail; the appearance is so singular that, at first, the opinion of naturalists was that it had been docked. These Monkeys are not so well known as others. In captivity it is noticed to be inactive and docile. A very decided difference is noticeable in its ability to handle objects with its hands; even in eating it is awkward and maladroit. It is blessed with the following names: Mono-feo, or Hideous Monkey, Chucuto, Chucuzo, and Caruizi. Its specific name is appropriate, meaning black-headed, in allusion to its black wig-like crown, and in contradistinction to the other species, the White-headed Saki.

The full-grown Cacajao reaches the length of two feet, the tail being only from three to five inches long. Its head is flattened at the temples, which gives it a striking appearance, contrasted with other Monkeys. The terms Yarke and Saki are applied to the various species of this genus, the present one being called the Black-headed Yarke, or Saki. It is found in the forests that border the Rio Negro, and the Cassiquiare, but is not seen in great numbers. Some naturalists fancy that this should be considered the American representative of the Magot or Ape of the Old World. The color of this Cacajao is black; the back and sides of its body are yellow. The loins, outside of thigh and end of tail, chestnut-red. It is the Simia melanocephala of Humboldt, P. melanocephala of Geoffroy, Brachyurus ouakaria of Spix, and O. Spixii of Gray. Habitat Brazil.

THE RED ACARI (*Ouakaria rubicunda*) has bright red fur, with fulvous yellow on the neck. The nape is pale yellow. It is the B. rubicundus of Geoffroy. Habitat Brazil.

THE WHITE ACARI (*Ouakaria calva*).—Azara speaks of this Monkey as the WHITE UAKARI, this latter being spelled as it is pronounced. He found it on the Japurá, and says that the natives "brought them down with poisoned arrows, and then restored them by putting salt into their mouths." The throat is of a deep golden red. The fur is fulvous, whitish on the back, and yellow or golden below and on inner surface of limbs. The tips of the hairs of the crown are black, and of some of the hairs of the back, gray. In the female the hairs are elongate, red and black. A variety has the back with some reddish hairs. This is the B. calvus of Geoffroy. Habitat Para.

TRIBE VIII.—HAPALINA.

The molars in this tribe are $\frac{4}{4}$ $\frac{4}{4}$, as in the Old World Monkeys. The lower cutting-teeth are vertical, in a regular series. The lower jaw is not dilated behind, as in the last cited tribe. The nostrils are far apart, and laterally placed.

HAPALE.

In this genus, the conch of the ear is rather large and prominent; externally it is bald, with cross band of elongated hairs on the inner surface of the conch, forming an elongated pencil. The tail is annulated. The lower cutting-teeth elongate, slender, linear, and as high as the canines. These are, as well as others of this tribe, possessed of only five instead of six molars on each side of the jaw. They have the same number as those of the Old World Monkeys, yet they differ from them more in other respects than any other of the *Cebidæ*, or American forms. The thumb is not opposable, and the fingers are provided with sharp claws. The great toe, or hallux, is very small; the tail is not prehensile, but is very long, and covered with fine hairs.

THE WHITE-EARED MARMOSET (*Hapale aurita*) is blackish in color, minutely punctulated with yellowish or reddish. The sides of head, limbs and hinder part, black; crown, brown; face, large; spot on the forehead and short ear-tufts, gray. A variety has the back blackish, without any indication of cross band. This is the Jacchus auritus of Geoffroy. A second variety has the back red, punctulated with narrow, faint, paler cross bands, especially on the loin. Jacchus humeralifer, is recorded by Geoffroy: "its face, shoulders, chest, arms and ear tufts are white; thighs brown, and white-grizzled." All inhabit Brazil. The latter, according to Bates, is found only in dry woods. The color of its fur is beautifully varied. When hungry or uneasy, it utters a weak, stridulous cry, like a grasshopper.

Hapale chrysoleucos is described by Natterer, in *Annals of Natural History*, for 1843, as being found in Bahia. A specimen of this variety is in the Museum of Vienna.

JACCHUS.

This genus has the conch of the ears large, bald, with a tuft of elongated hairs forming an expanded tuft on the ear, opening on its front edge. The hair of the sides of the crown elongate. Tail annulated with black. Back cross banded. Lower cutting-teeth elongate, slender, cylindrical, as long as the canines.

MARMOSET (*Jacchus vulgaris*)—Plate 3, fig. 9.—This elegant little creature is a native of Guiana and Brazil. The term OUISTITI is applied to it by some. It is characterized by a long and remarkably soft fur, varied by strips of brown upon a whitish or yellow ground, the outside of thighs and the back having gray cross bands, and the head a white spot on upper part of the nose. The tail is long and bushy, white, and encircled by rings of black. Curious radiating tufts of white hairs spring from the cheeks, contrasting boldly with the dark color of the head. The Marmoset is a favorite pet, and, though not as intelligent as other species, is susceptible of much cultivation, becoming attached to its keepers, and showing a good deal of affection. Its food is both animal and vegetable, feeding equally on insects and fruits. The length of the full-grown Marmoset is about seven or eight inches, the tail being twelve inches more. It is quite silent generally, but emits at times, when irritated, a sharp whistle, which gives rise to the term Ouistiti. Its habits are much like the Squirrel. Its size being so *petite*, it easily climbs over the limbs of trees and secures its favorite food, the eggs of birds. This is the Simia jacchus of Linnæus, Ouistiti of Buffon, Hapale jacchus of Illiger. A variety has ear-tufts white, and head black. Another, J. albicollis of Spix, has ear-tufts white, hinder part of the head, and back of neck, gray. A third, J. penicillatus of Geoff and Spix, has ear-tufts black, and head and neck black. A fourth variety, J. leucocephalus of Geoffroy, has black ear-tufts, blackish head and neck, and whitish forehead, temples and face. A fifth, J. leucogenys, has face, cheeks and throat, paler gray-brown than the fourth variety, but is otherwise the same. A sixth variety is like the third, with no white spot on the nose. Gray records a note as follows: "See Jacchus chrysopygus, Natterer—*Mikan, Del. Flor. et Fauna*—black; rump and inner sides of thighs, golden; forehead, lurid yellow; mane descending below the humerus; inhabits Brazil."

CEBUELLA.

This genus is characterized by having small, short and, externally, slightly hairy ears, hidden in the elongated reversed hair of the crown. It has no ear-tufts. The tail is dark-ringed. Back punctulated. The lower incisors are elongate, cylindrical, and as long as the canines.

THE PIGMY HAPALE (*Cebuella pygmea*).—This is ferruginous, yellow in color, with black and red, varied. The neck, chest, belly, and inside of thighs and arms, yellowish. Hands and feet are yellow-brown. It is the H. pygmea of Spix and Geoffroy.

MICO.

In this genus there are no annulations to the tail. The tail is black. The ears are large, exposed, and naked externally, and internally they have no pencil of hairs.

THE BLACK-TAILED MARMOSET (*Mico melanurus*). This is a rare form. Mr. Sclater gives a fine figure and description, in *Proc. Zōo. Soc. Lond.*, for 1875. It resembles somewhat the argentatus, and shows a nearly uniform silvery coat, whitest on the head and cheeks and on the upper surface of the toes. It has a black tail, sharply defined in color at its base. This is Jacchus melanurus of Geoff, and H. melanura of Wagner and Schreb. An albino variety is known; the tail, however, is black. Mico is a term used by Buffon; Simia argentata is Linnæus' name; Fair Monkey is Pennant's, and Pennant calls it Cebus canus. Bolivia is given as its habitat.

LEONTOPITHECUS.

This genus has head covered with elongate hairs, those round the face bent backwards. The face is rather naked; the ears being bald and partly hidden. The tail is not ringed. The lower cutting-teeth are short, and truncated. The canines are conical.

MARIKINA (*Leontopithecus rosalia*).—This exquisite little form is also called the SILKY MONKEY. Its graceful shape and extremely beautiful fur make it an attractive pet. The peculiar disposition of the fur around its neck has given it the trivial name of Lion Monkey; its size and habits, however, will hardly sustain such relations to the king of beasts. A rich golden sheen is the characteristic of its coat, its hairs having the appearance of the raw silk as it is unwound from the cocoon of the silk worm. The color is nearly uniform, the paws being somewhat darker. The Marikina is very cleanly, dressing its fur with extreme care. It is extremely timid, showing no disposition to resent injury, but escaping with the greatest agility when threatened by foes. Its voice is a sharp hiss, but it is seldom vented. Its body is about eight inches in length, the tail about twelve inches.

The Marikina is a golden yellow, with more or less red. A variety has head, feet, hands and end of tail, blackish. It is the Marikina of Buffon. Simia rosalia of Linnæus, and Midas rosalia of Geoff. Habitat Brazil.

BLACK AND GOLD MARMOSET (*L. chrysomelas*).—As the generic name imports, these creatures are called LION MONKEYS, the specific name indicating the black and golden hues. The fur is exceedingly rich in color, and fine in texture. The circumference of the face, the fore-arms, hands and base of tail are golden fulvous, the rest black. This is the Hapale chrysomelas of Prince Maximilian; several specimens of his own collecting now belong to the cabinets of the American Museum, Central Park, N.Y.

ŒDIPUS.

In this genus, the face and sides of the head are rather naked. The crown has a patch of hair which

is elongated in most instances. The tail is not ringed. The hair of the neck is elongated. The lower incisors are short and truncated. The canines are conical.

THE PINCHE (*Œdipus titi*).—This delicate little creature is about eight inches in length, its tail being about twelve more. Its voice is soft and gentle, and is compared to the twittering of a bird—hence, probably its name, titi.

GEOFFROY'S ŒDIPUS (*Œdipus geoffroyi*).—This is the Midas œdipus of Spix. It is gray-brown. The hair is soft, blackish at the base. The nape, back of the neck and base of tail, chestnut-brown. The crest, throat, chest, fore-legs and front of hind legs, white. The end of tail black. Salvin found it in Panama.

MIDAS.

This genus has the face and forehead hairy. The hair of the head is like that of the body. The ears are large, naked and devoid of tuft. The incisors on lower jaw short and truncated. The canines conical. The tail is black, and has no rings.

WHISKERED MIDAS (*Midas mystax*).—This species and the two following from one group, having the lower lip white, while the others have black nose and white whiskers; it was described by Spix, and located in the Upper Amazons and Peru. It is black, with back and thigh brownish-washed; beneath, it is dull black. Nose, and upper and lower lip, with a broad tuft of long white hairs—this latter character may have suggested the term mystax. Gray refers to a Midas pileatus of Geoffroy, which is "Brown, reddish-washed, with limbs and tail black; the crown bright red, nose and lips white."

RED-BELLIED MIDAS (*Midas labiatus*).—This is black, with the hinder part of the back washed with gray. Hinder part of the chest, belly and inside of the limbs and under side of the base of the tail, rufous. Tip of nose, and edges of the upper and lower lip, white. Bates locates them on the north side of the Amazon.

THE CROWNED MIDAS (*Midas rufiventer.*)—The specific name indicates a rusty belly, and the color bears it out. The general complexion is black; the hinder part of the back is washed with gray. Hinder part of the chest, belly and inside of limbs and under side of base of the tail, are rufous. Tip of the nose and the edges of the lips, white. The crown has a rufous spot, and the nape is gray. It is the M. elegantulus of Slack.

WHITE-CHEEKED MIDAS (*Midas leucogenys*).—This is black, with the outside of hind limbs washed grayish. The face is black, with a large triangular white spot under each cheek. M. nigricollis of Spix is near this.

THE BROWN-HEADED MIDAS (*Midas flavifrons*). Yellow fronted, literally, is this species, according to the specific name. Its head is a pale brown, the hinder part of back being rather mottled with white. Its general color is black.

A male is described having the outside of the limbs bright rufous-washed; the under side of body and inside of limbs, red brown. The female has outside of limbs and under part of body, blackish. Bates saw it in Brazil. In the Paris Museum there are two species, M. rufoniger, Geoffroy, Brazil, and M. devillii, Geoffroy, Peru.

Midas nigrifrons is another of Geoffroy's, from *Castelnau's Expedition to South America.* M. illigeri, is described by Pucheran, Colombia. M. fuscicollis is by Spix, from Bolivia. These varieties are more or less like the M. flavifrons.

THE TAMARIN (*Midas ursulus*).—This is the one most familiar to us. Buffon called it Tamarin négre, Linnæus, Simia midas, Geoff, M. rufimanus. Bates says these Monkeys are never seen in large flocks; three or four sometimes congregate. It seems to be less afraid of Man than any other Monkey. Its mode of progression is like that of the Squirrel, confining itself to the large boughs of the trees on which it travels. Its curiosity is sure to get the better of it, and when met with, it always stops and gazes intently at the intruder. Its expression is pleasing and intelligent; and this is due largely to its facial angle, which is 60°. The quick movement of its head, and the way they have of inclining the head to one side as they listen, gives them a knowing expression. This species is black, with hinder part of back rather mottled with grayish-white. One variety has black hands; another has yellow or orange hands.

SENIOCEBUS.

This genus has the head naked in front. The hinder part of the head is covered with short hairs. The ears are bald and exposed. The tail is not ringed. The lower incisors are short and truncated. The canines are conical.

PARTI-COLORED MIDAS (*Seniocebus bicolor*) has a gray coat, brown punctulated. The back of the head, neck, chest and fore-legs are white. The tail is black above, and brownish beneath and at the tip. In the young the face is hairy, with naked forehead. It is the Midas bicolor of Spix, Œdipus titi, junior, of Lesson, and Hapale bicolor of Wagner. Habitat Brazil.

MICOELLA.

This genus is represented by large and naked ears. The conch of the ear is large, covered both inside and outside with elongated hairs, which form a fringe on the circumference, but not a pencil. The tail is pale, but not annulated. The lower cutting-teeth are elongate and cylindrical, the two outer as long as the canines, the two middle rather shorter, and equal. "This genus differs from Mico in the ears being large, roundish, flesh colored, covered inside and out with distinct, rigid, expanding hairs, which form a double fringe on the circumference."

Micoella sericeus has white fur, soft and silky. The legs, feet and tail are a pale yellowish; the ears roundish, large and flesh colored. Found in Brazil by Natterer. This is the Hapale argentea of Sclater. In a later mention Sclater gives this as Hapale chrysoleucos.

THE WHITE AND GOLD MICO (*Micoella chrysoleucos*).—In this the fur is yellowish-white. The fore and hind legs, the belly and tail, are pale chestnut-brown. This is the Hapale chrysoleucos of Sclater. *Proc. Zōo. Soc.*, 1869.

ORDER III.—CHEIROPTERA.

WING-HANDED animals, comprising the Bats alone, are indicated by the term of this Order, the two Greek words composing the name meaning hand and wing respectively. They are found in all parts of the world, some groups being confined to the Eastern Continent, others are peculiar to the Western; while in some instances they are cosmopolitan. Species in this Order are very numerous, over four hundred having been described.

We have derived from Wallace's late work, *Geographical Distribution of Mammals*, the following arrangement of the *Cheiroptera:*

In the family *Pteropidæ*, he makes nine genera and sixty-five species, all belonging to the Old World exclusively.

In the family *Phyllostomidæ*, thirty-one genera and sixty species are recorded. These are the Leaf-nosed Bats, and are confined to the region east of the Andes, to latitude 33° South, in Chili. The "Blood-sucking" Bats, or Vampires, belong to this group.

The family *Rhinolophidæ* comprises seven genera and seventy species. These are the curious "Horseshoe" Bats, peculiar to the Old World.

In the family *Vespertilionidæ* he records eighteen genera and two hundred species, inhabiting various parts of the world: in America, as far north as Hudson's Bay and the Columbia River. In Europe they approach, if they do not pass, the Arctic Circle. The remote islands of Azores, Bermudas, Fiji, Sandwich, and New Zealand, all have representatives of this family.

In the family *Noctilionidæ*, there are fourteen genera and fifty species. These, called the Short-headed Bats, are found in every region, but irregularly distributed. In America they range from Mexico and California to Chili.

FOSSIL EXTINCT CHEIROPTERA.

In the Upper Eocene, fossil bones of this Order have been found by Cuvier. A complete skeleton of the form named Vespertilio parisiensis was taken from the Gypsum of Montmartre. Six fossil species have been found by Lund in the caves of Brazil.

Bats are naturally at ease while on the wing, or in the presence of an object sufficiently large to attach themselves to. Dark caverns are particularly desirable localities.

The extensive caverns in the mountainous regions of the Helderbergs and the Alleghanies are frequented by myriads. Here, particularly in the Cave of Schoharie, we have seen them clinging to the rough walls, densely massed. At such times, if suddenly put to flight, they appear to rise simultaneously, as a cloud, and the rush of air thus occasioned reverberates in deafening peals. Bats do not like the ground, and when forced to progress upon a surface, make a most uncouth appearance. They rise from the earth with difficulty, preferring to climb to a certain height, to throw themselves outwards and upwards, and thus to take wing. This is always accomplished with the head downwards, and with face towards the wall. It will be seen, then, that as they drop and take wing, they are sure to come right side uppermost. It has been a matter of surprise that the Bat, with its extremely minute organs of vision, can see so clearly and accurately in the darkest nights. The experiments of Spallanzani, testing this matter by depriving one of sight, and then submitting it to experiments, which proved that its eyes were not essential to a perfect performance of its customary evolutions, are given in detail, in vol. i, p. 49.

A curious habit in the Common Bat of the Northern States is known to every school-boy: "*Bat! Bat!!* come into my hat," is a familiar exclamation, and a toss of the old beaver into the air will most surely bring Bat *down*, and not unfrequently *into* the hat. When managed skilfully, the boy is apt to win. The skeleton of the Bat is much like that of the higher forms in its general aspect, and, in the possession of full-sized clavicles, its chest looks marvellously like the human. It is well named wing-handed, for the elongated fingers form a strong, yet delicate frame-work for the thin membrane which lies between. The thumb is highly utilized, notwithstanding it has been reduced, or rather has not been developed equally with the fingers; it serves the very important purpose of a support for the claws upon which the female Bat hangs while at rest with a lapful of young. The sense of smell is remarkably developed in the Bats, curious leaf-like appendages being seen in some, attached to the nostrils; this seems to argue a purpose, and the presence of similar appendages to the ear probably indicates a keen sense of hearing. A singular sucking apparatus is seen in the *Phyllostomes*, which aids them in drawing the juices of plants, or the flesh on which they may feed. During the colder season the Bat hybernates, seeking out some obscure recess of the cave that it frequents. See vol. i, p. 50, for an interesting account of this habit.

There is little to record of the habits of Bats. They are generally known as nocturnal or crepuscular in their mode of life. Opportunities are offered occasionally, however, for observing them. One of the most notable examples of the congregation of Bats is recorded in the *Smithsonian Miscellaneous Collections*, vol. vii, in the form of a letter from M. Figaniere, Portuguese Minister to the United States, addressed to Prof. Henry, Secretary of the Smithsonian Institution. He says: "Having purchased the property known as Seneca Point, in Cecil County, Maryland, near Charlestown, we took possession of it in May of the following year. The dwelling is a brick structure, covered with slate, in the form of an **L**, two storied,

with garret, cellars, stone laundry and milk house attached. The houses had remained unoccupied for some time, and appeared damp and neglected." The weather was warm and beautiful when they arrived, and they availed themselves of the occasion to sit on the open veranda and lawns. The chairs were scarcely occupied by them, when, to their amazement and horror, the air became clouded with small black Bats hovering about the house, entering and almost obscuring the early twilight, causing a stampede among the ladies, who fled, covering their heads, fearing the dreaded little vampires would make a lodgment in their hair.

An amusing description follows concerning the various means used in vain to exterminate them; scientific friends were applied to, and others sent various recipes, but all to no purpose. "Evening after evening did we patiently, though not complacently, watch this periodical exodus of dusky wings into light, from their lurking place, one after another, and in some instances in couples and even triples, according as the size of the holes or apertures from which they emerged in the slate roofing would permit. Their excursions invariably commenced with the cry of the Whip-poor-will, both at coming evening and at early dawn, and it was observed that they always directed their flight towards the river, undoubtedly to damp their Mouse-like snouts; they then returned to gambol, and satisfy their appetites, as the absence of Gnats and Musquitoes testified. I thus ascertained one very important fact—that this Bat ate and drank twice in twenty-four hours. Such appeared their habit. Upon ascertaining this fact, after having tried suffocation by sulphur with only partial success, I concluded to adopt a more efficient mode of warfare, and for this purpose ordered all the holes and fissures in the wood-work, and apertures in the slating, to be closed with cement. This put a stop to their egress; but to avoid their dying by starvation and deprivation of water, which would manifoldly increase the annoyance, by adding their dead to their living stench, I ordered apertures of about two feet square to be opened in the lath-and-plaster partition, on each side of the garret windows, and also in the ceiling of every garret room; lastly, when the Bats' *reveille* was sounded by the Whip-poor-will, all the hands of our establishment, men and boys, each armed with a wooden implement, shaped like a cricket bat, marched to the third floor, 'on murderous deeds with thoughts intent.' A lighted lantern was place in the middle of the room. After closing the windows to prevent all escape into the open air, the assailants separated at proper distances to prevent clubbing each other, and awaited the appearance of the Bats, enticed into the room by the artificial light, and impelled by their own natural craving. The slaughter commenced, and continued with sanguinary vigor for several hours. This succeeded perfectly. After a few evenings, the war terminated by the extermination of every individual of the enemy in the main building. There was, however, a cock-loft in the laundry, which gave evidence of a large population. In this case I had the slater remove the slates that needed repairing, and here were disclosed some 1500 or 2000 Bats, of which the larger number were killed, the remainder seeking the barns, trees and other places of concealment in the neighborhood. In the main building *nine thousand, six hundred and forty Bats. from actual counting*, were destroyed. The manure, as well as the bodies of the slain, was used to fertilize the flower and vegetable garden, and thus, in some degree, they served to compensate us for the annoyance to which we had been subjected."

With free use of disinfectants, it was five years before the stench from this enormous Bat-roost was eradicated.

The habits of the Bat favor the breeding and rapid increase of various pests, as Bed-bugs (*Cimex lectularis*) and Acari, in immense numbers.

An interesting anecdote is related in *Godman's Natural History*, by Titian Peale: "In June, 1823, a son of the keeper of a city park in Philadelphia, brought home with him a young Bat (*L. novebora-censis*). Three hours afterwards, in the evening, as he was conveying it to the museum in his hand, while passing near the place where he caught it, the mother made her appearance, and followed the boy two squares, flying around him, and finally alighting on his breast—such was her anxiety to save her offspring. Both were brought to the museum, the young one firmly adhering to the mother's teat. This faithful creature lived two days, but died of injuries received in its capture. The young was too small and immature to live."

Audubon relates an amusing incident that occurred to a guest, whom he does not mention by name, but who is known to be the eminent naturalist, M. Rafinesque. The latter had been assigned a room, and "when it was waxed late, and we had all retired to rest, every person, I imagined, was in deep slumber, save myself, when, of a sudden, I heard a great uproar in the naturalist's room. I got up, and reached the door, when, to my astonishment, I saw my guest running about the room naked, holding the handle of my favorite violin, the body of which he had battered to pieces against the walls, trying to kill the Bats which had entered by the open window, probably attracted by the insects around his lighted candle. I stood amazed, but he continued running around the room until he was fairly exhausted, when he begged me to capture one of the animals, as he felt sure they were a new species."

The Bats of North America have been so thoroughly studied by Dr. Allen, U. S. A., that we consider it as adding to the usefulness of this work manyfold by presenting the larger portion of the matter.

In the announcement by Prof. Henry, Secretary of the Smithsonian Institution (*Smithsonian Misc. Collections*, 165), in June, 1864, he says: "The following memoir by Dr. Allen is designed to exhibit the present state of our knowledge respecting the species of *Cheiroptera*, or Bats, found in America, north of Mexico, and their general geographical distribution. It is based principally on the specimens in the Smithsonian Institution and other American Societies." No order of Mammals has received so little attention

as the present. Gray, of the British Museum, has given a very thorough account of the Fruit-eating Bats, but they do not concern us, as they are all of the Old World—those, at least, that are technically so called. We have consulted many works, including those of the French and German explorers, on the zöology of South America and Central America, and have perused the long line of "Transactions" and "Proceedings" of the various learned societies, in hopes of bringing together a somewhat complete account of the Bats of the American Continent. The valuable collection of the Prince Maximilian, and the superb specimens procured from M. Verreaux, of Paris, all now in the American Museum, in Central Park, N. Y., have been consulted with advantage. Altogether, we find little of value that is not included in the "Monograph" by Dr. Allen. The habits, of course, are not well known, and are less likely to be observed than those of most other animals.

In Dr. Allen's "Monograph," he arranges the *Cheiroptera* under two principal sections: *Istiophora* and *Gymnorrhina*—the former having upright appendages on the nose, and the latter without them. The following single species, only, is classed under the former head; the others, commencing with family *Noctilionidæ*, are under the latter.

FAMILY—MEGADERMATIDÆ.

MACROTUS.—*Gray.*

This genus has the nose-leaf simple, triangular and acuminate. The ears are large and joined; the leafy appendage is simple and erect. The interfemoral membranes are large, giving rise to the family appellation, *large skin*. The point of the tail is free. The dentition is: Molars, $\frac{5}{6}$; Canines, $\frac{1}{1}$; Incisors, $\frac{4}{4}$; Canines, $\frac{1}{1}$; Molars, $\frac{5}{6}$; = 34 teeth.

THE CALIFORNIA BAT (*Macrotus californicus*).—The head of this species is long; face hairy. The ears are large, as its generic name imports, and almond-shaped, united over head by an incised, transverse membrane, and are slightly hairy. The fur is indistinctly tricolored. Above, the base is white, the terminal third fawn colored, and its tip white. The hair about the face is shorter, and more inclined to brown. Immediately behind the junction of the ears the head is almost naked. Its habitat is California. Specimens are found at Cape St. Lucas.

The Large-eared Bat is closely related to M. Waterhousii of Gray, from Cuba, Hayti and other West Indian islands, but is a distinct species.

FAMILY—NOCTILIONIDÆ.

NYCTINOMUS.—*Geoff.*

This genus has the ears generally joined; the lips are thick, pendulous and grooved. The nose is sharp and well defined. The tragus is obtuse, broad and square. The tail is produced beyond the interfemoral membrane, nearly half its length. The great toes are separated from the others, and are fringed on the outer side. The skull is very papery and inflated, the facial angle very small, the auditory capsules large, and lower jaw slender and elongated.

Nyctinomus nasutus, Tomes.—This is the Molossus nasutus of Spix, Dysopes nasutus of Temminck, N. braziliensis of Geoffroy, N. murinus of Gray, Nycticea cynocephala of Leconte, Molossus cynocephalus of Cooper, and M. fuliginosus of same author, Rhinopoma carolinensis of Gunlach and Nyctinomus mexicanus of Sauss.

The head of this species is rather large, the heavy, pendulous lips giving it a bulky appearance. The ears are as broad as high, obtusely square, almost joining at the top of the head; on their inner, anterior border, five small warts are observed. The outer border is emarginate at its upper, strongly concave at its lower portion, where at its basal third it is doubled upon itself. The mouth has upon it a bristled wart. The fur is thick, short, soft, and almost entirely confined to the body. Above, it is dark fawn at the tip, with a base of a whitish hue. It extends up upon the back of the ears one third their height. There is a very delicate patch on the interbrachial membrane. In front, the color is light cinereous at base; the tip is a delicate fawn. The foot is large; toes furnished with long hairs. This species is extensively distributed throughout the warmer parts of America. Specimens obtained in South America agree well with those found in South Carolina; and those from Hayti, also, are the same.

FAMILY—VESPERTILIONIDÆ.

NYCTICEJUS.—*Raf.*

In this genus the head is short, broad and flat. It has two upper incisors. The ears are small, simple, widely separated, with the basal lobe small and curved; the external basal lobe also rather inconspicuous. Between the latter and the angle of the mouth a small wart is seen. The tragus is straight on the internal, irregularly convex on the outer, border. The face is black; nostrils are simple, not produced, and very little emarginated. The sides of face are very much swollen. The lower jaw has a large naked place at the chin. Eyes are small, with a wart above on each side. The membranes are naked, blackish-brown, extending to the base of the toes. The tip of the tail is exserted. The fur is rather scanty, with the exception of a small patch at the base of interfemoral membrane. The color of the back is dark fawn on the upper half, and the lower is a lighter hue. Specimens are from Pennsylvania to Texas.

Nycticejus crepuscularis, Allen.—Vespertilio creeks of F. Cuvier, N. humeralis of Rafinesque.

LASIURUS.—*Raf.*

This genus is characterized by having the head depressed, lips slightly fringed, the nostrils wide apart, the skull flat and massive, occipital crest prominent, and the facial line abruptly elevated.

THE RED BAT (*Lasiurus noveboracensis, Tomes*). This is Vespertilio noveboracensis of Erxl, Nycticejus noveboracensis of Leconte. It is distributed over the temperate regions of North America, and is somewhat abundant. The head and face of this is hairy.

The nose is blunt, rounded slightly and emarginated, the nostrils opening semilaterally. The sides of the face are slightly inflated, and set with small bristles; a similar row of longer hairs surrounds the eyes. The upper lip, especially on the sides of the face, is more massive than the lower, and is somewhat produced. The ears are subrounded. The posterior surface of the ear is covered with hair one half its length. The fur of the body is silky and long, in front somewhat denser, but longer on the posterior portion. It is a light russet red in color, tinged with yellow. The hairs are tipped with gray towards the neck. At each shoulder, a conspicuous white tuft is seen. The basal joint of the thumb is also similarly decorated.

THE HOARY BAT (*Lasiurus cinereus, Allen*).—The Vespertilio pruinosus of several writers, V. cinereus of Leconte, Scotophilus pruinosus of Gray, Nycticejus pruinosus of Temminck, Wagner, Schinz and Prince Maximilian, and Lasiurus pruinosus of Tomes.

The head of this species is large, flat and hairy, the sides of the face somewhat inflated, the tips slightly whiskered. The nostrils are wide apart, and snout rather high and emarginated, the lower lip with a smooth naked space anteriorly. The ears are as broad as high, of a round form, with a large internal lobe. They lie close to the head, and nearly cover the eyes. The ears are black on the borders, and hairy to a considerable extent without, and less so within, the extreme border being naked. The fur is thick and soft in all parts. In color the neck, beneath the ears, is a faded yellow, the breast a dark fawn, tipped prominently with white; the two colors combined give the tint upon the axillæ. The head, and posterior surface of the ears, are of the same yellowish hue as the anterior portion of the neck. Below these points, the hair is everywhere of a rich chocolate-brown, tipped with white. The contrast of color gives a brilliant effect, and suggests the term Hoary, by which trivial name it is known. The dentition is: Molars, $\frac{5}{5}$; Canines, $\frac{1}{1}$; Incisors, $\frac{2}{6}$; Canines, $\frac{1}{1}$; Molars, $\frac{5}{5}$; = 32 teeth. Specimens have been obtained from Nova Scotia and throughout the Southern and Western States. It is occasionally found in New England.

Lasiurus intermedias, Allen.—In this species the head is large, flat and hairy; the snout is high, emarginate and brown in color; the nostrils open sublaterally. The sides of the face are somewhat inflated. There is a fringe of short hairs on the mouth and lower jaw. The ears are high, elliptical, pointed and nearly hairless. They are strongly convex on the inner border, and quite straight on the outer. At the base of the outer border is a well-developed lobe. The fur is not so full as in others. The general color is olive-brown. Hairs are blackish at base, of a dirty brown at centre. In front, the color is not so dark as in the rear. The dentition is: Molars, $\frac{4}{5}$; Canines, $\frac{1}{1}$; Incisors, $\frac{2}{6}$; Canines, $\frac{1}{1}$; Molars, $\frac{4}{5}$; = 30 teeth. The expanse of wings, twelve to thirteen inches. (Allen in *Proc. Phil. Acad. Nat. Sciences.*)

SCOTOPHILUS.—*Leach.*

This genus has the molars less than $\frac{6}{6}$, the head flat and broad, the lips swollen, tragus bluntish, and internal basal lobe of ear rounded and obtuse. It is closely allied to *Vespertilio;* the wing membranes are heavier in the former, and it has a thick and leathery ear and tragus.

CAROLINA BAT (*Scotophilus carolinensis, Geoff*).—Vespertilio of Geoffroy St. Hilaire, Harlan, Godman, Leconte and Cooper. The head is flat, nostrils emarginate. The ear is shorter than the head, is broad at the base, and obtusely rounded at its tip. The tragus is straight on the inner side, and on the other a little convex, and is nearly half the height of the auricle, and notched at the outer lower part. The nostrils are rather large, separated by an emarginate space. The tip of the tail is exserted. The hair is uniformly bicolored, except on the ears and margins of the body. On the back, it is dark plumbeous at the base. On the head, the hair is more woolly and thickly set; it covers half the posterior part of the ears and runs on almost to the nose; in the latter portion it is longer, and bicolored, as in the back. The fur on the under side is lighter than that on the upper. A light brown tinge tips each hair. The terminal joint of tail is exserted. The wing membrane is attached to the base of the toes. The dentition in S. carolinensis is: Molars, $\frac{4}{5}$; Canines, $\frac{1}{1}$; Incisors, $\frac{4}{6}$; Canines, $\frac{1}{1}$; Molars, $\frac{4}{5}$; = 32 teeth.

THE BROWN BAT (*Scotophilus fuscus, Palisot de Beauvois*).—Vespertilio fuscus of Leconte, Vesp. arcuatus of Say, Vesp. phaiops of Rafinesque and Wagner, Vesp. ursinus, Tem. and Prince Maximilian, Vesp. gryphus of F. Cuvier and Wagner, Vesp. caroli, Leconte, and Scotophilus greeni of Gray. The ears of this are moderate in size, leathery in structure, half erect and turned slightly outwards. They are convex on the inner border, straight on the outer, and slightly emarginate in some cases. The basal lobe is well developed. The tragus is nearly half as high as the auricle. straight on the inner border, somewhat convex, and diverging on the outer. It resembles the S. carolinensis very closely, and both approach very near to the S. serotinus of Europe. The dentition is similar to that of the last species. The wing expanse measures from nine to eleven inches. It seems to be well distributed throughout the Continent.

THE GEORGIAN BAT (*Scotophilus georgianus, Allen*).—This is the Vesper. georgianus of F. Cuvier, Leconte and Wagner, Vesper. monticola of Bachman, Vesper. crassus of F. Cuvier, and Vesper. salarii of the same. The head is flat, but less heavy and thick than the other Scotophili, and moderately hairy. The sides of the face are prominent and studded with hairs. The nose is flat, broad and hairless; the nostrils are small, oblique and opening sublaterally. The fur is thick, long and soft. Color is dark rufous-brown on the back, brighter in front. The base of the hairs in front and behind is a dark plumbeous. The fur extends to the upper third of the posterior surface of the interfemoral membrane, the anterior surface of which is decorated with numerous small tufts, ar-

ranged transversely. The fur of the body encroaches a little upon the front surface of the wing membrane. The wings extend to the base of the toes. The point of the tail is a little exserted, or free from the membrane. The skull is small and thin; it is flat, but not so much so as in other Scotophili. The dentition is: Molars, $\frac{5}{5}$; Canines, $\frac{1}{1}$; Incisors, $\frac{4}{6}$; Canines, $\frac{1}{1}$; Molars, $\frac{5}{5}$; = 34 teeth. The expanse of wing ranges from eight to nine inches. This Bat is found in Pennsylvania, and extends to Texas and Mexico.

THE SILVERY-HAIRED BAT (*Scotophilus noctivagans*).—This is the Vesper. noctivagans of Leconte, Vesper. audubonii Harlan, and V. pulverulentus of Temminck, Leconte and Prince Maximilian. The head of this Bat is flat, broad and moderately hairy. The snout is hairless; the nostrils are widely separated, opening sublaterally, the space between being emarginate. The sides of the face are somewhat swollen. The skin of the face and ears is blackish, with the exception of the internal basal lobe of the latter, which is whitish. The fur is long and silky, tending to black in color; in some cases, the tips of the hairs are hoary. The color is very much the same on both sides the body. The thumb is small and furred slightly; the wing is furred on the posterior surface. The dentition is: Molars, $\frac{5}{6}$; Incisors, $\frac{4}{6}$; Canines, $\frac{1}{1}$; Molars, $\frac{5}{6}$; and Canines, $\frac{1}{1}$; = 36 teeth. The expanse of wing is about twelve inches. This species resembles, somewhat, the European S. discolor of Kuhl. It inhabits the region extending from the Atlantic Coast to the Rocky Mountains. In some instances, specimens are found to be entirely black.

THE WESTERN BAT (*Scotophilus hesperus*), described by Dr. Allen as a very small species, and resembles the S. pipistrellus of Europe, in the shape of its head, &c. The head is small and flat, the face being blunt and stout, with no hairs. The wing membranes are attached to the base of toes. The body is slender. The tip of tail is covered by the membrane—not exserted. The fur is somewhat scanty, thickest on the back, where it is an obscure, dirty gray, blending in some to a brownish color, that in front being thinner and of a lighter hue. The bulk of the fur is a dark plumbeous, the above mentioned colors referring only to the tips. The dentition is: Molars, $\frac{5}{5}$; Canines, $\frac{1}{1}$; Incisors, $\frac{4}{6}$; Canines, $\frac{1}{1}$; Molars, $\frac{5}{5}$; = 34 teeth. Its wing expanse is about seven inches. Habitat California.

VESPERTILIO.—*Keyserling and Blasius*

In this genus the molars are $\frac{6}{6}$. The skull is inflated, raised above the line of the nasal bones; the internal basal lobe of the ear sharply defined, and more or less acute. Linnæus gave the term *Vespertilio* to the whole order of CHEIROPTERA. The word is suggestive and appropriate, as well as euphonious—referring to the crepuscular habits of the creatures described—as *Vesper-time* is the portion of the day when they "most do congregate" and sally forth. Geoffroy St. Hilaire restricted the term to the Naked-nosed Bats. It has been since used in a still more restricted sense.

Vespertilio evotis, Allen.—This has a head rather small, with pointed face somewhat covered with whiskers. The snout is produced; the ears are large, high, and erect and oval. The last joint of the tail is exserted, or free. The membranes are a light brown color, in some darker. Hair is long, plumbeous in color at the base behind, with light brown tips, inclined to yellowish towards the head. The fur in front is dark maroon, or black at base, with whitish tips. This has the largest ear of any American species of Vespertilio. The cranium is very much inflated, the face slender and pointed. Dentition: Molars, $\frac{6}{6}$; Canines, $\frac{1}{1}$; Incisors, $\frac{4}{6}$; Canines, $\frac{1}{1}$; Molars, $\frac{5}{5}$; = 38 teeth.

No specimens have been found east of the Rocky Mountains. It is common along the Pacific Coast, from Puget Sound to Lower California. Its wing expanse is from 8.–6 to 10 inches.

THE LITTLE BROWN BAT (*Vespertilio subulatus, Say*) is the V. californicus of Bachman and Peale, V. caroli of Wagner and Temminck, and V. domesticus of Green. The head is light, moderate in size; face is whiskered; ears smaller than in the preceding. The tragus is erect and half the height of the ear; the interfemoral membrane is smallest. The point of tail is exserted, or free. The dentition is the same as in the last mentioned. The expanse of wing is about nine inches. Specimens of this Bat are from Nova Scotia, Maine, and through the Middle States to Mexico.

Vespertilio affinis, Allen.—This is a new species, described by Dr. Allen. The head is moderate in size, slightly depressed; face hairy; ears small, inner border convex, outer concave. Lip is whiskered; body is robust; feet long and slender, a few curved hairs at the base of the nails. The wing membranes are attached midway to the base of the toes. The point of the tail is free; thumb is rather large; wing membranes dark brown, but thin. The fur is thicker behind than in front, and extends a little onto the interfemoral membrane. The color is a lustrous light chestnut-brown above; below, it is the same color of a lighter shade, inclining to yellowish. The dentition is the same as in the preceding. This is from the vicinity of Fort Smith, Arkansas.

THE BLUNT-NOSED BAT (*Vespertilio lucifugus, Leconte*)—V. brevirostris of Maximilian—has a large, somewhat flattish head, with lips covered partially with hair. The snout is more obtuse than in other species of *Vespertilio*. The nostrils are sublateral and some distance from the free border of the upper lip. The ears are narrow, blunt at the tip, and slightly emarginate on the outer side. The tragus is half as high as the auricle. A well-defined space on the chin. The feet are large, the interfemoral membrane of moderate size. The point of tail is free. The color is similar to that of V. subulatus. The dentition as in V. evotis. The narrow, blunt ear, short face and the elevation of the nostril above the free margin of the upper lip, are characters which distinguish this species. V. daubentonii of Europe bears some relation to this, in the shape of the ears and tragus. A form sent to the Smithsonian Institution,

from St. Louis, Dr. Allen remarks, has the wing membrane attached to the ankles, the foot being entirely free. In other respects, it agrees with V. lucifugus. This present species is common throughout the United States and south to Panama. Its expanse of wing is 8.6 to 10 inches.

THE GILA BAT (*Vespertilio yumanensis, Allen*).—From that dreaded military post, where the heat is said to be "unutterable," Major Geo. H. Thomas sent a specimen of this Bat, which Dr. Allen has named for the locality—Fort Yuma being situated on the Gila River. In general appearance, says Dr. Allen, this Bat resembles both V. subulatus and Scotophilus georgianus. It is, however, smaller than the former, the membranes more delicate, the foot proportionately larger, the interfemoral membrane smaller, but it agrees with it in the subulate tragus and in the dentition. Its relation to S. georgianus is seen in the light brownish snout and ear; its variance therefrom, in the longer and more acuminate tragus, the smaller size of the thumb, and the difference in the number of the molars. Its expanse is from 8.6 to 9 inches.

THE CALIFORNIA BAT (*Vespertilio nitidus, Allen*). This is described and named by Dr. Allen, in the *Proc. Phil. Acad. Nat. Sciences*, for 1862. It bears a strong resemblance to V. mystacinus of Europe. A specimen, labelled V. oregonensis by Dr. Leconte, in the Smithsonian Institution, is thought by Dr. Allen to be this species. The V. Nitidus is small in body; the head and face are very hairy; the nostrils separated by a narrow, slightly emarginate space. The ears are longer than the head. The lips are extensively whiskered; the thumb and foot small. The tip of the tail is rarely free. The fur is long and silky. The base of the hair is plumbeous, that behind having russet and brown tips, and in front it is a lighter russet or ashy on the tips. The interfemoral membrane is naked, excepting the usual tuft at the shoulders, and a few lightish hairs arranged transversely in front. The dentition as in V. evotis. As far as ascertained, this species is confined to the west of the Rocky Mountains. Its expanse of wing ranges from 7 to 8.6 inches.

SYNOTUS.—*Keyserling and Blasius.*

This genus has, as characters, very large ears, the outer border extended anteriorly as far as the tragus. There are large excrescences on the nose, continuous with the inner border of the ear. A semicircular fold is seen on the base of the outer border of the ear. It has no tongue-shaped appendage at the base of the inner border, as in the genus Plecotus.

As represented by Keyserling and Blasius in *Wiegm. Archiv. für Naturg.*, 1839, this genus includes both the species in the United States. It is closely allied to Plecotus, a European genus, as both are to Vespertilio. The skull is rather large; cranium is inflated, and it has no occipital crest. Dentition is: Molars, $\frac{5}{6}$; Canines, $\frac{1}{1}$; Incisors, $\frac{4}{6}$; Canines, $\frac{1}{1}$; Molars, $\frac{5}{6}$; = teeth 36.

THE BIG-EARED BAT (*Synotus macrotis, Allen*). This is the Plecotus macrotis of Leconte, P. lecontii of Cooper, Synotus lecontii of Wagner. The head is flat, not very broad, and the face is somewhat covered with hair. Lips are thin and compressed. The facial crest is elevated on a line with the nostrils, the latter being small and membraneous on the edges, and externally wider than internally, opening almost laterally, and with a shallow concavity between them. The ears are very large and slightly hairy on the internal border. The tragus is half as high as the ear, straight on the inner edge, diverging on the outer, and having a circular lobe at the base, almost at right angles to the tragus proper. The hair is long, fine and soft. On the upper parts it is dark at the base, quite blackish; the tips are dusky and brownish. The base of the ear is covered with hair, a delicate line extending up the internal border. The fur of the belly is like that of the back. The interfemoral membranes are naked, and the base of the thumb, also, hairless. The thumb and foot are slender, a few long hairs on the back of the latter. This Bat is confined to the South Atlantic States. Specimens range from nine to eleven inches in expanse of wing.

TOWNSEND'S SYNOTUS (*Synotus townsendi, Wagner*).—This resembles the preceding, but is stouter, and the membranes are somewhat lighter. The face is broader and more lengthened. The crests are high and well-defined, with the wart between the internal border of the ear and mouth larger than in S. macrotis. The tragus is of the same general shape, with marked lobe at the base. The small ovate lobe near the angle of the mouth is seen as in the preceding species. The limbs are slender, and the thumb and foot rather small. The hair is everywhere thick, fine and long. In color it is brown above, the hairs not so marked in two colors, the base being only slightly darker. In front it is lighter, where it inclines to a ferruginous brown at base. The back of the foot is slightly furred. The dentition is the same as in the preceding; the central incisors of the upper jaw are, however, more distinctly bifid at the cutting edge. It inhabits the central regions of the United States. Specimens are from Utah and Upper Missouri. The wing expanse is from ten to eleven inches. It is the Plecotus townsendi of Cooper.

ANTROZOUS.—*Allen.*

This genus is established in a paper by Dr. Allen, published in *Proc. Phil. Acad. Nat. Sci.*, 1862. It differs from Vespertilio in the high and slender snout, the crested and narrow skull, elevated, broad ears, and in having one incisor less on each side, in either jaw. The head is large; nose high, tapering and narrow; the snout angular and blunt; the nostrils situated on the apex of the snout; the outer borders are joined above in a transverse line; the eyes are large; the ears are longer than the head, and not joined. The skull is long, with a small crest at the posterior, tapering towards the anterior. The dentition is: Molars, $\frac{4}{5}$; Canines, $\frac{1}{1}$; Incisors, $\frac{2}{4}$; Canines, $\frac{1}{1}$; Molars, $\frac{4}{5}$; = teeth 28.

THE PALE BAT (*Antrozous pallidus, Allen*).—Leconte records it in *Proc. Phil. Acad. N. S.*, 1855, as Vespertilio pallidus, and Baird, also, the same, in *Report Mex. Bound. Survey*, 1858. The head of this spe-

cies is partially covered with hair of a light brown color. Over each eye is a small wart; between the outer border of the ear and angle of the mouth is a larger one, and under the lower jaw is another. The ears are high, elliptical, and at the hinder part of the base covered with hair. Along the inner border of the ear is a narrow slip of fur, and along the anterior portion of the ear is a still narrower band of fur. The tragus is half as high as the auricle, lancolate, and, in many instances, terminating in a fine point, sometimes in a blunt one; it is straight on its inner border, diverging on its outer, where it is finely toothed or crenulated. The outer border of the ear does not reach the angle of the mouth by several lines. The feet are rather large. Two varieties of color are observed—the fawn and the yellowish-brown. In the latter, the interfemoral membrane is destitute of hair, and at the base of the thumb a few brown hairs are seen. This Bat measures in wing expanse from eleven to twelve inches. Specimens are from California, Oregon, New Mexico and Texas.

SOUTH AMERICAN CHEIROPTERA.

D'ORBIGNY'S BAT (*Desmodus d'orbignyi*).—This is one of the "blood-sucking" creatures, or "Vampires," so dreaded by all travelers in the tropical regions of South America, and about which there has been much dispute, many naturalists doubting the truth of the stories told concerning its blood-thirsty propensities. Mr. Charles Darwin, during his travels, which are recorded in the *Voyage of the Beagle*, had opportunities to verify the statement that this Bat actually does suck the blood from beasts, and in some instances that of Man. He says they are the cause of much trouble in these regions. He was bivouacked on one occasion, near Coquimbo, in Chili, when his servant was aroused by hearing the horses restive, and apparently annoyed by some unusual cause. He thought he could distinguish some object on the horse, and when he suddenly clasped his hands upon it, found that he had captured a Vampire. In the morning, it was found that the horse's back was swollen and inflamed in one spot, and the blood had flown out of a wound made by some sharp agent. These Bats have no molars to grind food with, but have sharp incisors and canines. The small size of the interfemoral membrane gives greater freedom to the motion of the legs, and the unusually great size of the claw and thumb gives a greater power for this fastening upon the sides of beasts; there seems to be an evident development of parts for this mode of life.

Desmodus murinus is described by Wagner as having a range through New Mexico. Desmodus rufus of Maximilian appears to be the same as cinerea of D'Orbigny and the fuscus of Lund, which is found in Brazil, Bolivia and Guatemala. Tylostoma mexicana is mentioned by Saussure as common in Mexico. Macrotis mexicana of Saussure is very near the last named species, and is found in same region. A species, described by Gray as Macrotis waterhousii, is found in Hayti, Jamaica and other West India islands. Both of the latter are very closely allied, if not identical with, M. californicus of Baird. Mormoops blainvillei of Leach is found in Cuba and Mexico. Aelo cinnammomea of Schinz is also from Cuba. Five others of this genus are, respectively, from Brazil, Hayti and Jamaica. Phyllodia parnellii of Gray is from Jamaica.

In the genus Phyllostoma, there are twenty-two species recorded as inhabiting Brazil and Mexico. In the *Voyage of the Beagle*, Darwin gives a fine figure and description of Phyllostoma grayii. This is said to be the species described as P. childreni, from Pernambuco. Lophostoma is represented by two species in the Bolivian Cordilleras and in Guatemala. Centurio flavigulus of Gray is from Cuba, C. mexicanus of Saussure from Mexico, C. senex of Gray from Brazil, Schizostoma minutum of Gervais in South America generally. In the genus Glossophaga, or Phyllophora of some authors, is one species found in Surinam, Brazil and the West Indies. G. brevicaudum of Maximilian is hemiderma of some, and childreni of Gray; found in Brazil and Surinam. Glossophaga is Anoura of Gray; it has two species—ecaudata of Geoffroy, and geoffroyi of Gray.

The following named *Cheiroptera* are found in South America, or near Central America, and in the West Indies. Sturnira has two species. Arctibeus has seven, having a range from the West Indies to Chili. Brachyphyllia has one in Cuba. Sternoderma three in Mexico and Chili. Phyllonicteris one in Jamaica. Among the *Gymnorrhines*, Noctilio has two in Jamaica and Brazil, one being common to both countries. Nyctonomus is represented by two in the West Indies and in North America. Nyctellus lepidus is found in Cuba. Thyroptera bicolor and T. tricolor are, respectively, from the Amazon and Surinam. Emballonura has seven species in Brazil and Surinam. Diclidurus albus of Maximilian is found in Brazil; Ichnoglossa rivalis of Sauss in Mexico and Orizaba.

Dysopes, a genus widely distributed in the Old as well as the New World, has, according to Murray, twenty-one species on this continent, mostly in South America. Furipterus has two species; Natalus has also two, all from Brazil and Guiana. Hyonycteris is represented in two species in Central America and Quito. Nycticejus has two in South America. Lasiurus has four in America, and several in the Old World. Scotophilus has seven in South America and Cuba, as well as many in the Old World. Sixteen species of Vespertilio are found in the southern portion of this continent, ranging from Cuba to Chili. Many others are found in the northern portions, and in the Old World.

ORDER IV.—INSECTIVORA.*

THE Insect-eaters are characterized by having variable canine and incisor teeth, the molars being prism-shaped, with acute cusps. The feet are plantigrade, and provided with claws; the digits are not elongated, nor thumbs opposable. The clavicles are complete. As an Order, these creatures are not largely represented in America. They are not found at all in South America, nor in Australia. It is an interesting fact that those regions that form the exceptions, are inhabited by Marsupials; the latter being, as is well known, found in no other. One genus—Solenodon—which has given much trouble, in so far as its true place is concerned, is found in Cuba and St. Domingo. Some, as the North American Shrews, are found as far south as Mexico.

The food of these animals, as the name imports, is almost exclusively insects, worms, snails, etc. The teeth are found to be admirably adapted to their work, being provided with cutting edges for tearing, and flat surfaces for grinding their food.

Many of them live under ground, subsisting on worms obtained in the long and winding furrows, which they construct in connection with their nests. As mild and harmless as they seem—and no animal looks more so than a Mole or Shrew—they are really most vicious. They fight with exceeding fury, and the victorious curiously emulates the example of the lord of the forest, by scalping and mutilating his enemy. They are also excellent swimmers, being able to cross quite sizable streams.

EXTINCT INSECTIVORA.

The first traces of Mammals found by geologists were Insectivorous Marsupials. Remains, also, have been found at a very early date, which are referred by some to the true Insectivores. The Stereognathus, from Stonesfield beds, is claimed to be of this Order, though by others to be of the Ruminantia. A lower jaw of a small so-called insectivorous animal, named Spalacotherium, was found in the Purbeck beds; thus placing Mammalia midway between the older Oolitic and the older Tertiary Periods. The insect nature of these ancient forms is indicated by the presence of insects in large numbers in the Purbeck beds. In the Tertiary beds numerous remains are found, which have received the following generic names: Dimylus, Geotrypus, Hyporysius, Palæospalax. Talpa europea has been found fossil in the bone caves of Europe, T. coeca in Italy, T. minuta in South France, Dimylus paradoxus in Miocene beds at Weissenau, Geotrypus acutidens in Miocene of Auvergne, G. antiqus. in freshwater Miocene, Auvergne, Hyporysius tellurus, South France; Galeospalax mygdaloides in Auvergne, Palæospalax magnus in Ostend. Sorex foidens has been found fossil in England. S. araneus from France. Seven species of Sorex have been taken from the Miocene of France. A genus—Mysarachne—with one species from Auvergne, and Plesiosorex talpoides, from the same. In Sansans, France, a Blarina.

A well-approved arrangement of the members of this Order is that of Dr. J. A. Wagner, in the fifth volume of his supplement to *Schreber's Saügthiere*, published in 1855. Five families are established, as follows: *Dermoptera*, Indian Archipelago; *Scandentia*, India, Borneo and Java; *Soricidæ*, East Indies, Europe, Africa, North America; *Talpidæ*, spread over the whole world, save South America and New Holland; *Aculeata*, confined to the Old World. Of these, only two families concern us, viz: *Soricidæ* and *Talpidæ*.

FAMILY—SORICIDÆ.

The ancient naturalist, Pliny, has left us the term *Sorex*, a Shrew-mouse, which is now embodied in the present family designation. The Shrews are Mouse-like in appearance, with a considerably elongated muzzle. There are no distinguishable canines, except, perhaps, in some cases spurious ones. The bony annulus of the orbit is wanting, or imperfect. The ear has a distinct concha. The feet are regular and normal, the anterior pair being smaller than the posterior. These characters of feet and ears distinguish it readily from the Family *Talpidæ*. On the sides of the tail of these creatures are peculiar glands.

SUB-FAMILY—SORICINÆ.

Under this head we have three genera, belonging to North America, viz: Neosorex, Sorex and Blarina. These are spread over the whole of the northern hemisphere, some being seen very far in the North. The region of the Rio Grande is their southernmost limit, though, in the Old World, species are found in Southern and Central Africa.

The genus Sorex includes the larger number of the American species. The largest forms are found in the genus Blarina; and these are quite unlike any of the Old World.

NEOSOREX.

This genus, established by our accomplished American naturalist, Prof. S. F. Baird, is characterized by having the ears rather short, and partly furred on both surfaces; they are also valvular in form. The dental formula is given as follows: Anterior Incisors, $\frac{2}{2}$; Lateral Incisors and Premolars, $\frac{5}{2}$–$\frac{5}{2}$; Molars, $\frac{4}{3}$–$\frac{4}{3}$; = 32. The upper anterior incisor has a well-defined hook at the base, the lower one with two tubercles and a notch. The first two upper premolar teeth are equal, and larger than the fourth, which exceeds

* For much of the material under the present and succeeding Orders, we have drawn upon the *U. S. Pacific R. R. Reports of Explorations and Surveys. Zöology by Prof. S. F. Baird.*

the third, and equals the basal hook of the anterior one. The fifth is smallest. All the teeth are colored at the tip. The tail is longer than the body, with a pencil of hairs at its end.

NAVIGATOR SHREW (*Neosorex navigator*).—This species is described by Prof. Baird from a skin sent to the Smithsonian Institution, by Dr. Cooper, which he procured at Fort Vancouver, W. T. It is said to very nearly resemble the S. fimbripes of Bachman, but may be distinguished by its longer tail, which is nearly one half longer than the body, instead of being shorter. The hind feet are much longer. The fur is very long and full, and is extremely soft; its color above and on the sides is a mixed, hoary and smoky brown.

SOREX.

This genus is common to both Continents, and embraces the larger portion of existing species.

TROWBRIDGE'S SOREX (*Sorex trowbridgii*) has a slender body, elongated, with a snout broad, depressed and pointed. Its whiskers are numerous, moderately long, and light colored. The ears are unusually large. The fore-feet are large in proportion, and quite broad. The palms are broad; and the tail is the length of the body. The color is a dark sooty brown or black, intermixed with hoary. Its habitat is principally in the North Western Territories; it is not found east of the Rocky Mountains, being as common on the Pacific side as Scalops aquaticus is on the Atlantic.

THE VAGRANT SHREW (*Sorex vagrans*).—From Dr. Cooper's ms., the present species has been described, and also from skins sent from the Western Territories to the Smithsonian Institution. S. vagrans is characterized by having the ears moderately large; fur rather long and full; feet rather small; tail longer than the body, scantily haired at the tip. The third lateral tooth above is smaller than the fourth. The anterior, upper incisor has a rounded internal lobe, in broad contact with its fellow. The color above is olive-brown, varied with hoary; beneath, it is dusky yellowish-white. Sides are a little paler than the back. Head and body measure two inches; tail one and two thirds. The teeth are all chestnut colored at the tips.

SUCKLEY'S SHREW (*Sorex suckleyi*).—This differs from the preceding in being of a chestnut-brown, instead of an olive-brown color; the belly is less pure in its lighter parts. Its fur is much shorter, the feet smaller, the skull broader, and ears considerably smaller. The species is named for Dr. George Suckley, one of the naturalists connected with the Western expeditions. The color above is a light chestnut-brown; beneath, it is grayish-white. Its length is two and a quarter inches; tail one and a half.

THICK-TAILED SHREW (*Sorex pachyurus*).—This is readily distinguished from the others by its full fur, thick tail, large feet, &c. It is found in the North Western States. Baird describes it as a new species, and remarks: "The body of this species appears unusually stout and full, owing to the length of the fur, which exceeds that of any American species with which I am acquainted, measuring on the back five lines. Its large feet and claws, and very thick tail, are also highly characteristic. The tail appears very thick, as much so as in Mus musculus. All the teeth are chestnut in color at the tips."

FORSTER'S SHREW (*Sorex forsteri*).—This is one of the older and well-known species. It was first noticed by Forster, in the *Trans. Acad. Nat. Sciences of Phil.* It is found in the Eastern States, being quite common in New York. It is small, of a dark cinereous color, tipped with brown; beneath, it is cinereous. Its fur is short; ears broad and hairy. Tail is nearly as long as the body. In length it is four inches. DeKay gives the following description: "Body slender; nose elongated and divided at the tip; whiskers long, white and black; fur fine and short; feet slender, with five white and slender toes; tail four-sided, with a slight pencil of hairs at the tip."

RICHARDSON'S SHREW (*Sorex richardsonii*).—Baird records the present species, with the following remarks: "A single skin of what I believe to correspond to the S. richardsonii of Bachman, has a considerable resemblance to S. forsteri, but is larger, and the tail shorter in proportion. Like it, the ears are small for this group, less than in the much smaller S. cooperi. The tail is shorter than the body, exclusive of the head, but scantily provided with hair. The hairs of the back are very short, only about 0.15 of an inch. There is a distinct gland on the side, about one third of an inch long, and one twentieth wide, covered with short, close, silky hairs, indicating the position of the musk gland. The color above is a rusty iron-gray, the under parts lighter."

THE BROAD-NOSED SHREW (*Sorex platyrrhinus*). This little species is thought to be closely allied to the Long-nosed Shrew of Bachman, but differs in general color, larger size, and its proportionally longer tail. De Kay, in *Natural History of New York Mammals*, speaks of a specimen found by Mr. Bell at Tappan, in Rockland County. It was captured in a cellar of an old house, was exceedingly agile, and when excited, emitted a shrill, twittering squeak. It ate greedily of flesh, but died in a few days. It seems quite unaccountable why certain animals die so quickly after capture, though they may be well cared for, and seemingly, no harm has been done them. The Broad-nose is so minute that it has gained the reputation of being one of the smallest quadrupeds on the Continent, the weight of one specimen being only 47 grains. In distribution, it is known to range from Eastern Massachusetts to Ohio, and as far north as Burlington, Vt. Its specific characters are: ears large and conspicuous, tail scarcely longer than the body, and only scantily provided with hair. The upper premolars are imbricated anteriorly, and decreasing gradually in size. Color above, chestnut or dark brown; beneath, pale cinereous. Length over two inches; tail scarcely exceeding one and a half inches. The ears are large, and generally very distinctly visible.

COOPER'S SHREW (*Sorex cooperi*).—This is another of a group of Shrews that have considerable resemblance to each other. Their habits are not well known, consequently there is little to be recorded,

excepting some of the characteristic features which may render them distinguishable to the inquiring reader. The specific characters of this Shrew are: body very slender and small; ears rather large; longest hairs on back about one and a half lines. Feet slender, but moderately long. Tubercles on the sole, large and distinct. Tail nearly as long as the head and body, well pencilled at the tip. Third upper premolar tooth above equal to the fourth. Premolars not imbricated. Anterior upper incisor with an inner lobe in contact with its fellow. Color above, light chestnut-brown; beneath, pale brownish or chestnut-white. Length mostly under two inches; tail one and ten twelfths.

HAYDEN'S SHREW (*Sorex haydeni*).—This resembles the S. personatus, excepting in size, the latter being smaller. The hands are broader in the present species, and the tail is larger and thicker. It also bears a close resemblance to S. cooperi. Its colors are light, but not bright, grayish, chestnut-brown above; beneath, lighter yellowish-white, with a tinge of brown. The tail is brown above, dusky at the tip and beneath, with the feet light gray. The tip of the teeth are pitchy-chestnut. The teeth are thirty-two in number. The specific characters are: Head less than eight tenths of an inch, acutely attenuated. Body about $1.\frac{75}{100}$ of an inch; vertebræ of tail, $1.\frac{25}{100}$. Tail very thick and swollen; hind feet, four tenths of an inch.

THE MASKED SHREW (*Sorex personatus*).—This species was described by Bachman formerly as the S. longirostris, and is continued as such in *Audubon and Bachman's N. A. Quadrupeds.* It is nearly the smallest of the group. The specific name of this species would seem to indicate some special characteristic, but we cannot find any allusion to the matter in the various descriptions published. This is probably one of the too frequent cases of attaching meaningless names. If a creature has a remarkable specific character, it should by all means be recognized, by adoption of its name; but there is little sense in calling an animal *masked*, when their are no signs of such a character present. The color above and on its sides is a light chestnut-brown; beneath, dull white, with a tinge of chestnut. Length, one and three quarter inches; tail, one and one twelfth. This species is considered to be closely allied to S. platyrhinus, though smaller. The tail and hind feet are shorter in proportion. Its habitat is throughout the Middle States.

HAY'S SHREW (*Sorex hoyi*).—This is from Wisconsin, and measures about the same as the preceding. Its color above is olive chestnut-brown, with a little hoariness. It is described by Baird as very small and slender, with prominent ears; very small feet, the posterior five eighths the length of the skull. Tail about the length of the body, exclusive of the head. Only four lateral upper teeth. All the teeth large and dark colored. Anterior upper incisor with very prominent, serrated lobe on the inner face, in contact with its opposite.

THOMPSON'S SHREW (*S. thompsoni*).—"The smallest species," says Prof. Baird, "that has come under my observation, one specimen weighing less than twenty-two grains. It is readily distinguished, by its olive-brown color and small number of lateral incisors, as well as diminutive feet, from S. personatus and S. cooperi. In form, it resembles S. hoyi, but is much smaller in size and proportions, much darker in color, has larger ears, less dentations on the lower anterior incisors, &c. It is named after the late Zadock Thompson of Vermont.

BLARINA.

This genus includes the short-tailed Shrews, and a prominent characteristic is the apparent absence of ears. It is considered a very natural group, and one differing entirely from any other in the world. The Blarinas are divisible into two sections: A. with five premolars in upper jaw, and B. with four upper premolars.

THE MOLE-LIKE BLARINA (*Blarina talpoides*), called, also, the CAROLINA SHREW.—This is one of the section A., having thirty-two teeth, including five premolars in upper jaw. This is a large species, measuring three and a half to four inches, with a tail four tenths of an inch. Its color is a bright lustrous iron-gray over the surface, the base being of a slate color. The nose and feet are flesh colored. The nests of this Mole are about a foot under ground, composed of fibres of roots and grasses. They feed on worms, larvæ of insects, etc. It is the most abundant of the North American Shrews, and is found everywhere in the Northern States, reaching south as far as Georgia.

THE SHORT-TAILED SHREW (*Blarina brevicauda*). This is the largest of all the North American Shrews. The prevailing color is a blackish-plumbeous on the back and sides, dark plumbeous beneath. There is sometimes a faint purplish gloss on the fur above. The head is very broad and massive, rather obtuse. Tail, with its hairs, about as long as its head.

De Kay says he has seen specimens from New Jersey, and has heard of its capture in Albany. It has been taken in Connecticut, also. From a specimen taken in Queen's Co., N. Y., the following description is given by De Kay: "Rostrum robust, broad; whiskers numerous, long, radiating; those along the margin of the mouth, 0.5 long. A projecting fleshy septum just anterior to the two upper incisors, and extending nearly between them. Fur thick, moderately long, dark brown, very sparse around the region of the mouth and on the extremities, rather allowing the skin beneath to be seen; rather more dense on the tail. Nose dark brown, bifid. Eyes, with a small naked space around them, 0.55 distant from the nose. Auditory hole large, transverse, narrow beneath, naked, with an oblique septum across the upper half, and a small lobe near the middle, about 0.6 posterior to the eye. Fore-feet 0.5 long; three toes subequal, longest; outer slightly longer than inner. Tubercles on the palm, six—two in a line behind the inner toe, and two behind the outer, the fifth between the base of the second and third toes (counting from the outside), and the sixth is placed at the base of the fourth toe. On the hind feet the tubercles are

similar in number and situation, but are larger and more distinct. Tail cylindrical, very slightly tapering. Total length, 4 inches; of the tail, 0.75; hind feet, 0.75." Specimens of this Shrew are described by Prof. Baird, from Illinois, Nebraska and Iowa.

CAROLINA SHREW (*Blarina carolinensis*).—This is the species described by Bachman as the CAROLINA SHREW. In size, it is considerably smaller than B. talpoides. Its body is stout, with large feet, and a moderately pointed nose. The hand is large, broader than the foot, its claws being considerably longer. Soles naked, except on the heels. Tail is short, rather less than the head, with short bristly hairs forming a pencil at tip. The color is a dark leaden-gray above, beneath a little paler, with a faint gloss of dark sooty-brown on the tips of the hairs above, and a very slight hoariness produced by a paler bar near the tips of the hairs above. This species differs from brevicauda in having much smaller hands and longer tail. Its body is somewhat smaller. This Shrew is common in the Southern States.

NARROW-HEADED SHREW (*B. angusticeps*).—Baird describes a Shrew from Burlington, Vt., under the above name. "In external appearance," he says, "it perfectly resembles the B. talpoides, and carolinensis, but is intermediate between them in size." It has some remarkable peculiarities in skull, the latter being much narrower than any he had seen. The outline of the jaw outside of the molars, as viewed from above, instead of being convex is stright. The color is nearly an uniform bluish-gray all over, with a wash of brown on the back; the feet and tip of tail are white. Its length is $2.\frac{60}{100}$; tail 1.00.

ASH-COLORED SHREW (*Blarina cinerea*).—This species, with those following, belongs to the section B, having four upper premolars, 30 teeth. It is found in various parts of the country, from the Eastern States to Georgia and Florida. Its color above is iron-gray, glossed with dark olive-brown; beneath, it is a light gray. Color of the tail sharply defined. Head and body about two and a half inches. Tail 0.70.

WEAK-FOOTED SHREW (*B. exilipes*).—This is a very small Shrew, having remarkably small feet. Its body is slender. In color, a hoary olive-brown above, with a chestnut tinge; beneath, it is grayish-white. Tail is bicolored. In size, the head and body are less than two inches; tail about 0.60. The crowns of the teeth, as in other species, have the chestnut coloring darkest on the tips.

BERLANDER'S SHREW (*B. berlandieri*).—This is another small species, with a moderately stout body. Its fur is full, compact, and soft, but short. The ears are small, and inconspicuous. It is readily distinguished from others, except B. exilipes; from this it may be known by its shorter hair, which resembles long piled velvet, and from the feet, which are broader and larger. More distinction is seen however, in the teeth, which are much larger every way. The colors are different. The Rio Grande is the most northern limit. No other Shrew has been found so far South.

THE MARSH SHREW (*Sorex palustris*).—This is regarded as a strongly marked species. It is found in the region of Hudson's Bay, but not in the United States. Its length is three and a half inches; the tail is two and seven twelfths. The back is hoary-black; the belly ash-gray.

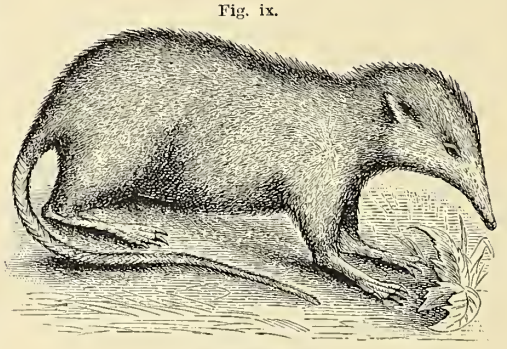
FRINGE-FOOTED SHREW (*Sorex fimbriata*).—Dr. Bachman describes this species from a single specimen found in Lycoming Co., Pennsylvania. It measured two and an eighth inches to the root of the tail, the tail one and three quarters. Above, the color is brown; beneath, it is buff. The fur is unusually long. The most notable characteristics are the broad fore-feet, and the curious fringe of hairs which border them. The great paws quite resemble those of a turtle.

THE SMALL SHREW (*Sorex parvus*).—A species described by Say, in *Long's Expedition*, 1823. It resembles closely Bachman's S. cinereus.

HARLAN'S SHREW (*Sorex harlani*).—A very small Shrew, collected first by Lesueur at New Harmony, Ind., and described by Duvernoy. It has thirty teeth, and measures two and a fourth inches in length. Its color above is brownish-gray, and a purer gray beneath.

THE SOLENODON (*Solenodon paradoxus*).—This little creature, also called AGOUTA, has been a puzzle to naturalists; hence its specific name. It is found in the island of Hayti. Several characters common to other families are united in this form. Its teeth place it among the Shrews; some external characters give it an aspect common to the Opossums. Its fur is long, harsh and coarse; in color a pale red, tinged with yellow. It is rather larger than the common rat, having a tail similar to the latter. The dentition of the Agouta is singular. Van der Hoeven says: "The two middle incisors of the lower jaw are small, narrow, placed between two long, conical ones, and

Fig. ix.



The Solenodon.

are *hollowed on the inside by a deep groove*; the second grooved incisor of the lower jaw distinguishes this genus from all the others of which the dental system is known hitherto." Two middle incisors of the upper jaw are extremely large, almost triangular in form, and are separated from the small lateral incisors by a considerable interval. This dentition would seem to indicate an insect diet, but a living specimen showed a preference for grain.

In general aspect the Solenodon resembles the rat as he is seen casually. One species of this curious creature is all that is known at present. The generic term signifies channel-toothed.

FAMILY—TALPIDÆ.

This family is characterized by the absence of external ears, by having no visible neck, the fore-feet greatly expanded, with stout fossorial claws, and limbs very short. The auditory opening is in some species very minute, in others as large as usual. The eye is extremely small, and often concealed by the integument. The nostrils are sometimes at the end of the snout, and in others lateral or superior. In one genus the snout is surrounded by a fringe, which radiates evenly in the form of a star. The tail is usually short; in some it is as long as the body. The fur is soft, compact and velvet-like. Moles are distributed over the world, with the exception of intertropical portions, and South America and Australia. Three types are peculiar, respectively: Talpa to Europe and Asia; Scalops to North America; Chrysochloris to South Africa. All are quite limited in species. Urotrichus is a genus hitherto considered peculiar to the Cascade Mountains of Washington Territory, but has lately been found in Japan, and thus proves to be the only one known to inhabit the two continents.

In America the Moles are found in almost all portions, as far south as Mexico. Condylura inhabit the northern portion of the United States, from the Atlantic to the Pacific. One, or possibly two, species of Scalops is restricted to the Pacific Coast; one to the Atlantic; one is found sparsely in Massachusetts, New York and Ohio, and another on the prairies of Michigan, Illinois and the West.

The genus Talpa does not exist in America, nor does the American Scalops inhabit any part of Europe.

A genus—Chrysochloris—called the Cape or Gilded Mole, from its beautiful greenish-golden fur, is confined wholly to South Africa. It differs from the true Moles in having three fingers developed in the fore-paws, instead of five. The teeth are less in number; but in general aspect, and in habits, it resembles the Mole; their galleries are somewhat deeper. Three species are known: one from the Cape, one from Natal, and a third from Mozambique.

EXTINCT SPECIES.

The Mole has been found fossil in bone caves and diluvial deposits, and several extinct species of Mole-like animals occur in the Miocene deposits of the south of France and of Germany.

SCALOPS.

This genus is characterized by an elongated nose, without fringe; nostrils superior or lateral; eyes hidden; tail short; teeth thirty-six or forty-four, the two anterior upper ones unusually large, and somewhat like those of a Rodent. The feet have very large, broad palms; the claws are large, depressed, five in number; the hind feet much narrower than the anterior; the toes are more or less webbed to the claws. The tail is short, naked and hairy. Eyes are very small, sometimes covered by the integument. Snout is long, depressed, conical and cartilaginous. The nostrils open either at the end of the muzzle, or laterally or superiorly.

COMMON MOLE (*Scalops aquaticus*).—This species has the same designation as the European species, but the habits and general appearance are quite distinct. The American Scalops aquaticus, or Shrew-mole, has thirty-six teeth; eyes and ears excessively minute; the former not covered by integument. Nostrils antero-superior; palms broader than long, claws included. Tail nearly naked; feet fully webbed. Color dark plumbeous, with occasionally a brownish tinge. Feet and tail white. This form is bulky and shapeless; its claws are the most noticeable feature, being large and immensely strong, as is requisite for the work that it accomplishes under ground. Its favorite food being the earth-worm, gardens are consequently the scene of its labors, as well as other localities, where it proves often to be a doubtful benefactor—the good resulting from the destruction of earth-worms being counterbalanced by the innumerable furrows executed just below the surface of garden beds and walks. The Shrew-mole has a wide geographical range, being found from Carolina as far as 50° of North latitude, and from the Atlantic to the Pacific Coast. In size it is the same as the British species—about seven inches in length.

SILVER OR PRAIRIE MOLE (*Scalops argentatus*).—This is very similar to the preceding, and small specimens are with difficulty distinguished. It is larger than S. aquaticus, palms rather narrower, and has a silvery plumbeous fur, which has been likened to recently cut lead. The general color of the feet and tail is white, the latter being more hairy than in the other species, as well as longer. The ear is also a little larger. A species is described by Bachman, under the name Scalops latimanus—Broad-handed Shrew. Its characters are given as follows: Larger than the common Shrew, intermediate in size between S. townsendii and S. breweri. Hair longer and thinner than on either of the other species, and slightly curled. Palms larger than any other known. Tail naked, and color nearly black. Inhabits Mexico and Texas.

OREGON MOLE (*Scalops townsendii*).—This species is characterized by a general color of dark purplish, almost sooty-black, nearly uniform. Eye small, not covered by integument. Tail rather scantily covered by hair. Nostrils opening on the upper surface of the tip of the snout. Palm large and broad. A variety from California is less in size, with palms, tail and muzzle thicker. The nostrils are more terminal. The color is a light sooty-brown. Tail more hairy.

HAIRY-TAILED MOLE (*Scalops breweri*).—Distinguished by large ear openings, eyes covered by integument, lateral nostrils, rather narrow, a densely hairy tail, dark plumbeous color, glossed with ashy-brown. The fur is long and full, not quite so glossy and soft as in the S. aquaticus.

CONDYLURA.

This genus has the peculiarity of the fringed or star-shape to the nose, a series of elongated caruncles surrounding the end of the snout. The nostrils are

circular and terminal; tail nearly as long as the body, covered by hair. Auditory opening large. This group of Moles is peculiar to the northern portions of North America.

STAR-NOSED MOLE (*Condylura cristata*)—Fig. 18, vol. i, p. 64.—This has the general form of Moles. The color is a uniform dark sooty-brown or blackish. The tail is long, without the hairs, about as long as the body, exclusive of the head. The term Condylure, meaning "knotty-tail," is absurdly given it, and has even been adopted as a generic designation, because the tail, when dried, becomes knotted, from the protusion of the vertebræ. The rayed appendage gives to this creature a most singular aspect, situated on the extremity of its long and slender snout; its uses are not clearly understood, though it may be serviceable in affording a delicate medium of touch, while in the dark caverns that it delights in.

UROTRICHUS.

This is a genus established by Temminck, which is characterized as follows: "It has the muzzle prolonged into a cylindrical tube, which is continued some distance beyond the incisors, and terminates in a simple, naked bulb. The nostrils are cylindrical, and open on the side. The eyes and ears are concealed. Tail is long and hairy. Fore-feet moderately large, and shorter than the hind ones, the upper and under surfaces of both covered with small plates." The interesting fact of the discovery of a member of this group in America is thus recorded by Prof. Baird in *U. S. P. R. R. Explorations and Surveys. Zöology*, vol. viii: "I have the pleasure of first introducing a genus of Insectivorous Mammals into the Fauna of North America, hitherto only represented by a single species, the U. talpoides from Japan. The specimen is unfortunately not quite mature, and the skull, with its dentition, is imperfect, so that I am obliged to rely on Temminck for the dental formula. In external form, this animal exhibits a close resemblance to Condylura, the only striking difference being in the much elongated and tubular muzzle, without radiations, and the nostrils lateral, not terminal. The feet, hands and tail are very similar. The dental formula, according to Temminck, is: Incisors, $\frac{1}{1}-\frac{1}{1}$; Canines, $\frac{1}{0}-\frac{1}{0}$; Molars, $\frac{8}{7}-\frac{8}{7}$; = 36; or, as there are three true molars, the latter quantity would be divided into: Premolars, $\frac{5}{4}-\frac{5}{4}$; and Molars, $\frac{3}{3}-\frac{3}{3}$. The analogy of dentition would, however, make the formula more probably: Incisors, $\frac{3}{2}-\frac{3}{2}$; Canines, $\frac{1}{0}-\frac{1}{0}$; Premolars, $\frac{3}{3}-\frac{3}{3}$; Molars, $\frac{3}{3}-\frac{3}{3}$; $= \frac{20}{16} = 36$. The genus Urotrichus in many respects resembles the Shrews, and, in fact, may be considered as forming the connecting link between this family and the Moles, through Condylura."

GIBBS' MOLE (*Urotrichus gibbsii, Baird*).—The only specimen of this Mole known, at the time the above record was made (1854), was obtained by Mr. George Gibbs, of Steilacoom, near the White River, Cascade Mountains, Washington Territory. It now bears the number 662, as a cabinet specimen in the Museum of the Smithsonian Institution. It is said to bear a close resemblance to the Condylura in color, feet and tail, from which it is readily distinguished by the much elongated muzzle, and the absence of the radiated snout. Its size is about that of the Sorex carolinensis. Its color is a uniform dark sooty-plumbeous. The body is about two and a quarter inches long, and the tail is the same length, exclusive of the head. The latter is constricted at its base, thickened at the middle slightly, and comes to a gradual tapering at the end. It is rather smaller than the Japanese U. talpoides, as described by Temminck, the feet and tail being proportionately larger. The color of U. talpoides is maroon-brown. The skull of this specimen was too much injured, and was too immature, to present the dental and other important characters. The permanent teeth had not taken their places. Prof. Baird has, however, been able to give the following: "The skull is broader, and narrows anteriorly rather more abruptly than in Scalops. The nasal bones extend as far as the anterior edge of the upper incisors, as in Scalops, not in Condylura. There may be made out an anterior scalpriform incisor, broader than in Scalops, and projecting downwards and behind the two smaller ones of similar shape. The permanent canine is not distinguishable, unless this be indicated by the emerging crown of a tooth, apparently with two roots. The premolars each have two roots. The molars are three in number. The lower anterior incisor is much as in Condylura—broad, horizontal and half spoon-shaped."

ORDER V.—CARNIVORA.

THE Carnivorous animals, or Flesh-eaters, include those beasts formerly known under the systematic term FERÆ, which constituted an Order of the older naturalists. They are now grouped as follows: *Plantigrades*—those that walk upon the flat palms and soles—the Bears; and *Digitigrades*—those walking upon their digits, or toes and fingers—the Dogs and Cats. The Seals are by some authors included, and are called *Pinnigrades*, from the fact that they progress by means of their fins, or fin-like feet. The teeth of the *Carnivora* are sharp and scissor-like, four of them being stout and long, and adapted to tear as well as to cut the flesh of their prey. The clavicles are very small, and in some instances are entirely wanting. The stomach is very simple, and the intestines are short. Individuals of this Order are found in every part of the habitable globe, between two and three hundred species having been described.

Scanty remains of the Carnivorous animals have been found fossil in the Eocene and the Lower Miocene formations. In the caves of the diluvial deposits, about the time of the Glacial Epoch, fossil remains were deposited. The caves of Brazil have furnished very interesting material, attributable to

the Pliocene Epoch. Some bones have been found in the *Mauvaises Terres*, east of the Rocky Mountains. All that were deposited before the Glacial Epoch are regarded as belonging to a different type from that of existing *Carnivores*.

FAMILY—URSIDÆ.

This small group includes the Bear-like forms embraced in the genera Gulo, Taxidea, Procyon, Nasua and Cercoleptes. They are small in size, and differ from the true Bears in having longer tails.

GULO.—*Storr.*

In this genus, which has but one existing species (allowing the American and European to be identical), there are thirty-eight teeth. The molars are five in number above, and six below. The lower sectorial tooth has no internal tubercle. The soles are densely hairy, and furnished with six small, naked pads. The tail is nearly equal to the head in length, and is very bushy. The body is stout, and has quite the aspect of the true Bears. In the essential features of dentition and general structure, the genus Gulo is like the Martens and Weasels, though differing greatly in shape. The hairy under surfaces of its paws, and its being only partially plantigrade, have served to place it among the latter, in the arrangement of some authors. Baron Cuvier, however, regarded it and other genera included in this group, as having a place here, among the Ursidæ.

Fossil remains of Gulo have been found in the bone caves of Germany and in France. Two species were enumerated, but Baron Cuvier considered them as belonging to existing species.

THE WOLVERINE (*Gulo luscus, Linn.*)—Plate 11, fig. 36.—This is the Mustela gulo of Linnæus, Ursus gulo of Schreber, G. borealis of Nilsson, Keyserling and Wagner. It is identical with the Glutton of Europe, and was first described by Linnæus as Ursus gulo, and afterwards as U. luscus. For a time it was regarded as distinct in species from the European animal. The Wolverine is an inhabitant of the colder regions of the two continents, though it is occasionally seen in Northern New York. In the Rocky Mountains it is common; and it has been seen in some parts of Missouri. The most southern locality known is the basin of the great Salt Lake. Fabulous accounts are extant concerning the ferocity of this creature. In this country it is principally notorious for depredations among the traps of the Marten hunters, whose bait, and even captured prizes, it frequently purloins. In the districts north of Raquette Lake, in New York State, it is yet occasionally seen. The celebrated John Hunter, a half breed among the Indians of Canada, calls this creature *gwing-gwah-gay*, which, he says, means a "tough thing," or, a "hard character," referring undoubtedly to its character and disposition. The Wolverine was formerly found as far south as Carolina. It is rare in all regions. Prof. Emmons states that it still exists in the Hoosac Mountains, Massachusetts. Though having a reputation for ferocity, it is said to flee from Man quite willingly, and the hunter requires little else but a stout staff to kill it.

The Glutton feeds on small quadrupeds, and, as we have seen, when pushed by hunger, readily resorts to dead carcasses of the traps. In general aspect this creature is not unlike a Bear, and Linnæus, on that account, placed it under the title Ursus. It is not often seen alive in collections. A specimen was kept in the Zöological Society's Gardens, in London, where an opportunity was offered to study its habits to a certain extent. It was said to have rather a good-humored aspect, except when it showed its teeth. It was restless, and climbed the trees with ease, playing upon the branches with considerable skill and freedom. The young are said to make their appearance about May—the litter numbering from two to four at birth. Its specific characters are seen in its dark brown hair, black tail and legs (save the base), a lighter broad band on the flanks, which passes over the base of the tail and rump, and a grizzled light patch along the temples. The head is pointed somewhat, as in the Bears. The muffle is naked for about a half an inch from the end of the snout. The eyes are very small; the ears, also, are small and concealed in the fur. The feet are large and strong; these, with the legs, are striking characters, giving it much of the ursine aspect that is noticeable in this species. The claws are very large, sharp and curved, the fore-feet being more formidably armed. The soles are densely covered with stiff hairs. The color is pretty uniform dark purplish-brown; the sides of the neck, and a spot between the legs, are white. The length of the Wolverine is about thirty-six inches from nose to root of tail; the vertebral tail, nine inches; the hair of the tip, five inches more.

TAXIDEA.—*Waterhouse.*

This genus is characterized by having a stout, robust and depressed body, a short tail and remarkably large and fossorial claws. The posterior upper molar is very large and subtriangular. The skull is wedge-shaped. The dentition is: Incisors, $\frac{3}{3}-\frac{3}{3}$; Canines, $\frac{1}{1}-\frac{1}{1}$; Premolars, $\frac{2}{3}-\frac{3}{3}$ (including the upper sectorial); Molars, $\frac{1}{2}-\frac{1}{2}$ (including lower sectorial); = 32 teeth. In young specimens there is an additional premolar (first), which soon disappears; this adds 1—1 premolar to the lower jaw, making 34 in all. This genus is common to North America only. Two species are known—one in Mexico, and the other inhabits the Western U. S. and British Columbia. Skulls brought from Mexico and California were examined by Waterhouse, and he established the genus, erroneously regarding the British-American species as identical with the present. It is regarded as astonishing that this animal should have been confounded with Meles of the Old World. The most noticeable feature in Taxidea is in the occipital region, which is greatly expanded, the width being equal to that of the skull. The skull of Meles is more like Procyon than Taxidea. In the latter the occipital crests are well developed, the saggital only moderately. The differences between these two forms are seen also in the teeth, though they have the same number.

Under the term Badger, Murray records "three and

possibly five species: the European, whose range extends through Europe and Asia from the Atlantic to the Pacific, and the two species in North America. Besides these, there is in Eastern Siberia a larger variety, confined to the Steppes, the common species of Siberia being found only in the woodlands." Temminck has described another, by the name of Meles anakuma, from Japan; the latter is considered by some to be nearer the North American species—Murray doubts it. Fossil remains have been found in the bone caves of Europe belonging to two extinct species.

THE AMERICAN BADGER (*Taxidea americana, Baird*).—This animal is widely distributed throughout the United States, ranging from Wisconsin to the Pacific Ocean, reaching far to the north. South of latitude 35° it appears to be replaced by the species berlandieri, called Meles labradoria by Bennet, *Proc. Zöo. Soc., London*, 1833, and Meles americanus, by Zimmerman in *Pennant's Arctic Zöology*. "The differences between the European and American," says Prof. Baird, "are so strongly marked as scarcely to require a comparison. Thus, in the former the sides and top of the head may be described as white, the end of the muzzle completely encircled by this color; a little more than half way between the snout and the eye commences a stripe of black, truncate anteriorly, and sending down a small branch towards the canine; this stripe widens gradually, including the eye and ear, and is lost on the shoulders. The black of the legs extends over the throat to near the end of the chin. There are thus on the top and sides of the head five stripes—a median and two lateral white ones, and two intermediate of black—in addition to black beneath the head and anterior to the ear, all the stripes of the same width. In the American Badger the top of the head is grizzled with a narrow white median line; the end of the muzzle, top and sides, is black; the cheeks are white, with a crescentic black patch anterior to the ear. The whole under parts of the throat and head are white. The naked muzzle of the European is much larger than in the American." The most striking differences are to be seen in the hairs of the upper part of the muzzle, the smaller ears, the stouter feet and claws, the more conical or wedged-shaped head, &c., of the American species. The length of this latter is twenty-two inches from the nose to root of the tail. The tail, in its vertebræ, five inches; the same, including the hairs, six inches. See also vol. i, p. 74.

THE MEXICAN BADGER (*Taxidea berlandieri, Baird*).—This is the T. labradoria of Waterhouse, and Meles labradoria of Bennet, *Proc. Zöo. Soc., London*, 1833. In specific characters it is like the American Badger, but has the light line on the top of the head continued, with intervals to near the root of the tail. It is described by Prof. Baird in *Report of Mex. Bound. Survey*, and in *Pacific R. R. Reports*.

THE KINKAJOU (*Cercoleptes caudivolvulus*)—called also POTTO.—This creature has been somewhat of a puzzle to naturalists. Its general aspect and its habits have led some to regard it as allied to the Lemurs, and it earned the name of Yellow Macauco from that circumstance. Yellow Lemur (*Lemur flavus*) is another name it also has borne. It was then placed next to the Viverras, under the name Mexican Weasel (*Viverra caudivolvula*). Its teeth, having flat surfaces, and its curious prehensile tail, were characters that seemed to remove it from the Carnivorous tribe; and, since it eats both animal and vegetable food, it is now ranked with the ursine animals. The Kinkajou inhabits a large portion of

Fig. x.

The Kinkajou.

South America, and reaches as far north as Mexico and the West Indies. It is known as Honey Bear, Manariri or Guchumbi. The adult is equal in size to a common house Cat, but is much more powerful physically. It has a most remarkable tongue, one that can be protruded to an unusual extent; indeed, it seems to be as useful to the animal as the prehensile tail, for it can insinuate the tip into places where insects are congregated, and adroitly remove them to its mouth; in this way, too, it extracts honey from the comb of the wild Bees. It has the faculty of using the tail for similar purposes, much the same as in the case of the Spider Monkeys. It is thoroughly nocturnal in habits, finding daylight troublesome to its eyes. The pupils are susceptible of great expansion and contraction. It is said to utter a low, bleating sound, as it emerges at twilight, and then, in the acceptable shades of night, it gambols with great activity and skill upon the trees of the forest. It is easily tamed, becoming to its master much as the pet Dog is, ready to play, and affects to bite precisely like the latter. Though in this tamed state it is affectionate, and receives with great apparent pleasure any fondling or caresses, yet, when wild, it is extremely ferocious, offering a most determined and spirited resistance when assaulted by Man.

THE BROWN COATI-MONDI (*Nasua narica*)—Plate 11, fig. 38.—This genus, an exclusively American one, has only five species, one of which—the N. braziliensis—is fossil, and found in the bone caves of Brazil, and is extinct. The Nasua narica (sometimes also called Quasjic) derives its name from the Latin, meaning nose, which might suggest a convenient trivial designation, as *Nosey*. It is a lively and funny creature, very common in collections, both as living and preserved specimens, and is often tamed and kept as a pet in its native country. A good

series of the species is seen in the cabinets of the American Museum at Central Park, N. Y., and living ones in the Gardens of the Zöological Department. In general habits the Naricas resemble the Raccoons; they climb well, and have the same diet. Their snout, so remarkably produced, is useful in rooting the ground, and no doubt they procure insects and other food with as much facility as the Hog with a similar organ. The Coatis have a curious set of tubercles on the surface of the feet, which are quite characteristic. They are nocturnal in habit, confining themselves a good deal among the branches of trees, where they rob the nests of birds; though they resort, as we have seen, to the ground, when they are obliged to "root, or die." Though becoming a safe and interesting pet, when kept in confinement, it proves a formidable enemy when opposed in its wild state. Several species of this genus have been recorded: the N. monticola of Peru, by Tschudi and N. socialis of Prince Maximilian, which is the N. rufa of Desm, annulata of the same, and striata of Shaw. This is the Coati of Mexico and South America, the Nasua solitaria of Maximilian, and nocturna of the same author. Is found in Guiana, Brazil and Bogota.

PROCYON.—*Storr.*

The generic characters of Procyon include a pointed muzzle, short and oval ears, long and bushy tail. They have five toes, and strong, non-retractile claws. The feet have naked soles. In walking they rest upon the toes, but drop down on the heel when standing. The mammæ are ventral, six in number. A gland on each side of the anus secretes a disagreeable fluid. Linnæus placed the Raccoon with the Bears, on account of its plantigrade feet. The body is densely clothed with two kinds of hairs—the outer long and coarse, the inner more soft and like wool.

THE RACCOON (*Procyon lotor, Storr.*)—Plate 11, fig. 37.—The Raccoon is too commonly known to require a detailed descriptive account of its parts. Its geographical range is very large, being found in every portion of North America, as high as 60° North, on the Pacific side. Lewis and Clark saw it on the Columbia River, and it has been found in Northern California. Its southern limits are not so well known. In Paraguay, specimens have been obtained. Its habits are mostly nocturnal. Though it eats animal food, it seems to prefer vegetable. It is credited with the habit of washing or soaking its food in water whenever it is possible to do so, and for this it has received its specific name *lotor*, or *washer*. The German naturalists term it *wasch-bär*, or Washing Bear. The body of the Raccoon measures about two feet, exclusive of the tail; the limbs are short and narrow; the tail is about ten inches in length. The fur is used in the manufactures, sometimes for hats. Though classed with the plantigrade or palm-walking animals, it steps on its toes, or rather, the heel is elevated when it walks, while the true plantigrade puts the *whole* palm down.

Coon hunting is one of the much-prized sports of the Southern States, especially with the negroes. An experienced Dog is set upon the trail, and, after a chase, the Coon is "*treed.*" A blazing fire is then made of pine chips, directly under the tree, which illuminates its branches, rendering all quite visible. One then climbs the tree, and dislodges the creature. Audubon delights in a description of a Coon hunt, and adds: "It would be a good scene for a skilful painter. The woods present a wonderfully picturesque appearance on such an occasion."

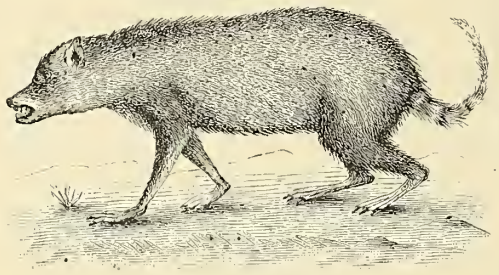
The Raccoon is exceedingly dextrous with its forefeet, and, when tame, follows its keeper with the same constancy as the Dog or Cat. It ascends trees readily, and is often tempted aloft for the dainty prize of a nest of eggs. It watches Turtles as they lay, despoiling their nests, adroitly uncovering the eggs in the sand. Its favorite resorts are retired swampy lands, well covered with lofty trees. The young at birth are very small, six in number, brought forth early in May. A hole in a rotten tree is preferred for its nest. In the Southern States, the banks of the streams near salt water are lined with a small oyster, which is so sought after by the Coon that it has received the name Raccoon Oyster. The Raccoon hybernates, as the Bear does, for several months. It is sometimes called Mapach, though the term Coon is a more thoroughly universal one. The generic name Procyon is from the Greek—before the Dog; its literal meaning indicates the relative position of the two members of the *Carnivora*.

BLACK-FOOTED RACCOON (*Procyon hernandezii, Wagler*).—This in general appearance resembles the P. lotor. In size it exceeds it. The feet are larger and stouter, and the bare portion of the palms extend further up the wrist. The tail is longer and thinner, and tapers slightly at the tip. The black rings are narrower and better defined; only the terminal three or four encircle the tail completely. The range of this Raccoon is from the Rio Grande of Texas, west to the Pacific, as far as Cape Flattery, near Puget's Sound. Another specimen is described, under the variety name mexicana. The general markings are said to be much like those of the preceding, but the color is lighter, the long hairs being tipped with dark reddish-brown, instead of black. The feet are whitish above, the hinder ones with a tinge of chestnut on their outer portion. The tail has six distinct annulations of purplish-chestnut, besides the tip; the intervals rusty-whitish, a little larger than the dark rings.

THE PSORA, OR CALIFORNIA COON (*Procyon psora, Gray*)—During the voyage of the British corvette Sulphur, Sir Edward Belcher procured this species on the Coast of California. Prof. Gray described it in the *Annals and Magazine of Nat. Hist., London* (1842), giving it the present name. It is recorded as having a "tail reduced to stump." The figure given of this particular specimen in the *Voyage of the Sulphur*, is evidently made from memory, or possibly was drawn by an unskilled hand, as its form is quite unlike that of specimens since obtained, and the coloring does not correspond to descriptions made from the actual object. A good specimen, now in the American Museum, Central Park, N. Y., shows the tail about fifteen inches in

length, but, as is seen in fig. xi., which was drawn from it, exhibits the terminal half quite *mutilated*, the end having the appearance of having been broken

Fig. xi.



The California Raccoon.

off. while the hairs are, on the latter portion, apparently sparsely set, or are accidentally bruised and disarranged. The specimen obtained by Sir Edward Belcher was from the Sacramento River. Its close proximity to the variety of Procyon hernandezii (P. mexicana), which is found in Sonora, as well as its general resemblance to the latter, suggest that a further examination may prove to unite them. Prof. Baird says: "Upon the whole, though the description is not sufficiently perfect to admit of a minute comparison, I am inclined to consider the P. psora as essentially the same with the Sonora specimen, with only a smaller cheek patch, and both of them varieties of P. hernandezii." The dimensions given are as follows: the head and body twenty-seven inches in length; tail, three inches; hind foot, four and a half: skull, five inches long and three and a half inches broad.

THE CRAB-EATING RACCOON (*Procyon cancrivorus*).—A trivial name of this is AGONARA, known as such in Central America and further South. The specific title is thought to be erroneously chosen, as it is not more given to Crab-eating than others. In size it is rather above the common species. The tail is shorter in proportion to the body, and is marked with six black rings upon a grayish or blackish-yellow ground. A dark patch encloses each eye, and, passing backwards almost to the ears, is merged into a dark spot on the crown. In various parts of the country it is called Maxile, Wasch-bär, and Ciontlamacasque.

URSUS.—*Linn.*

Bears are regarded as forming one of the most clearly-defined groups in the Animal Kingdom. They constitute the typical genus in the family *Ursidæ*, and, with later writers, form a group which they entitle *Tribe Plantigrada*. They are rather sparsely distributed as regards species, and are specially represented in the temperate regions of the North American continent. A few species are found in the same latitudes in Europe and Asia, and a single species—the Ursus ornatus—inhabits the Andes of South America. One only is found in Europe, the common Brown Bear (*U. arctos*), which is also found in the northern portions of Asia. Wallace enumerates the species as follows, viz: "Thalassarctos, the Polar Bear, one species; Ursus, the true Bears, twelve species, which range over all the Nearctic and Palæarctic regions as far as the Atlas Mountains, the Indo-Chinese sub-region in the mountains, and to Hainan and Formosa; Helarctos, the Malay or Sun Bear, one species, confined to the Indo-Malayan sub-region; Melursus or Prochilus, the Honey Bear, one species, confined to the first and second oriental sub-regions, over which it ranges from the Ganges to Ceylon; and Tremarctos, the Spectacled Bear, commonly known as Ursus ornatus, which forms a distinct group."

A good deal of discussion has been recorded concerning the relative characters of the Bears of the two continents; it is now pretty well established that those of Europe differ from the American sufficiently to indicate distinct species. The Bear has certain characteristic habits common to all. In most instances it climbs with great facility, appearing to be as agile, in proportion to its immense size, as a Squirrel. Its flexible limbs and long, well-armed paws, give it a sure lodgment among the branches of the forest. In mounting a tree, the Black Bear leaps like a Cat to the lower branches, and then readily pulls himself upwards on the outstretching limbs. We have witnessed this feat with surprise and pleasure at the Zöological Gardens in Philadelphia, where the Bear-pits are extremely well planned and well kept. The Bear is a good swimmer, and digs with the immense power that his big paws suggest. Its diet is exceedingly varied; leaves of trees are eaten with apparent relish at times; Bees and their comb form a favorite portion; and in winter, when the weather has pinched it to extremity, it resorts to roots, which are skilfully unearthed by the long and powerful claws. The young are usually from one to four in number, and are quite small during the first few days of existence. The litter is usually produced about the end of January or the first of February, and it is an interesting fact that the Bear, though having been deprived of food for several months, is yet able to sustain a tolerable condition while nursing the litter. They are unsocial creatures, frequenting the deep ravines and caverns, or inaccessible heights, and usually singly, or in pairs. The extraordinary habit of hybernating is considered more fully under the description of the Black Bear. The dentition of Bears exhibits a design of a frugivorous nature rather than carnivorous exclusively, and the formula is the same as in the *Canidæ* generally. The molars in the lower jaw number seven, the maximum known to the Mammals of placental structure. A peculiarity of the premolars, or smaller grinding-teeth, is seen in their transitory nature; they are very small, and are often destroyed or lost. The first and fourth of these premolars are usually persistent. A difficulty in determining species is found in the variations in size at maturity, and in the very considerable difference between the sexes. For example, the males of Ursus arctos and U. americanus, have the forehead flatter and less arched transversely than the females and young males. The dentition is: Incisors, $\frac{3}{3}-\frac{3}{3}$; Canines, $\frac{1}{1}-\frac{1}{1}$; Premolars, $\frac{4}{4}-\frac{4}{4}$; Molars, $\frac{2}{3}-\frac{3}{3} = \frac{30}{22} = 42$.

FOSSIL EXTINCT URSIDÆ.

In the Pliocene of France, a form of Ursus was found to be different from any of the present living genera, and has been named Hyænarctos. This also appears in the Upper Miocene of the same localities. It is as large as the skeleton of the Cave Bear (*Ursus spelæus*), and has characters approaching those of the Hyænas. In the Siwalik Hills of North Western India, this form is found in the Upper Miocene deposits. In the Tertiary Period, in America, the *Ursidæ* are represented by one form—an extinct genus from the Pliocene of Nebraska—called Leptarchus. The Post Pliocene of the Brazilian Caves of South America has furnished nearly all we have of that continent. These caves are numbered by thousands; they are in the limestone of the province of Minas-Geraes, a district near the head-water of the San Francisco River, in Central Brazil. Only sixty of the thousands visited contained bones in any quantity. They have a floor of reddish earth. "In one experiment," says Dr. Lund, "half a cubic foot of this earth contained jaws of 200 Opossums, 2000 Mice, besides remains of Bats, Porcupines and small Birds. In another trial the whole of the earth in a cavern was carried out for examination, amounting to 6552 firkins; and, from calculation made by measured samples, it was estimated to contain nearly seven millions of jaw bones of Cavies, Opossums, Porcupines, Mice and other small Mammals and Birds and Reptiles. This immense accumulation is believed to have been formed from the bodies of animals brought into the caves by Owls; and, as these are unsocial Birds, the quantity found implies an immense lapse of time. More than an hundred species of Mammals, in all, were found in these caves. Some were living species, or closely allied to such, but the majority were extinct, and a considerable number—about one fourth—belonged to extinct genera, or genera not now inhabiting South America. Stone implements were found, in connection with human remains, in several of the caves, with extinct animals. Fossil extinct *Ursidæ* were represented here by a form called Arctotherium, which is closely like the genus containing the Spectacled Bear of Chili. The Hyænarctos is found in the Pliocene of the Pampas and in Patagonia.

A remarkable series of bones have been found in the Miocene beds of Europe and in the Siwalik Hills, which are allied to both Dog and Bear; they have been given the family name *Arctocyonidæ*. The genus Amphycion is a member of this family. Prof. Owen regards this as the forerunner of the Plantigrade tribe. The latter was found in the Miocene beds of the south of France. In the Miocene of Epplescheim a smaller species has been found, which has been referred to the Wolverine genus, under the name of Gulo diaphorus. During the Pliocene Epoch, the Bears seem to have been exceedingly numerous. The great Cave Bear was very abundant in Central Europe and Southern Russia. In the British Museum are crania of great dimensions, indicating an enormous beast, exceeding by far the present Polar species. Remains of a different form have been found in Spain. One resembles the present Bear of the Pyrenees. In North America the Pliocene of Illinois has furnished an extinct form, called Ursus priscus. U. amplidens is from the same formation. Arctodus is an extinct genus, recorded as lately found in North America.

THE GRIZZLY BEAR (*Ursus horribilis, Ord*).—This is eminently the superior of all the Carnivorous animals of this continent, both in size and in its dreaded attributes, for *Ephraim*, as he is familiarly termed by the trapper, is too fond of attacking Man without provocation. This being true, it affords almost the only instance of the kind known, all other animals readily or instinctively avoiding the gaze of Man. The Grizzly Bear derives its name from the occasional silvery and grizzled appearance of its coat, the latter being extremely variable, sometimes bearing a chestnut-brown, and in the others ranging from that to a steel-gray. Its coat is very thick and heavy, and in the young animal actually hangs in long masses from its sides. The fore-limbs of the creature are enormously powerful, the paws being, in the adult, eighteen inches in length, and armed with sharp non-retractile claws five inches in length. The length of a full-grown adult averages between six and seven feet, and its weight eight hundred pounds. In the collection of the American Museum, at Central Park, N. Y., is a specimen of this size, which was captured by the Prince Maximilian, while travelling in the West. A fine living specimen, in the Zöological Collection at the same place, shows the fur of a dark chestnut color, and very thick. The specific characters of the Grizzly are: Extreme size; tail shorter than the ears; hair coarse, darkest near the tips, with light tips; an erect mane between the shoulders; feet very large; fore-claws twice as long as the hinder ones; a dark dorsal stripe from occiput to tail, and another lateral one on each side along the flanks, obscured and nearly concealed by the light tips; the intervals between the stripes are lighter; all the hairs on the body, brownish-yellow or hoary at tips; region around ears dusky; legs nearly black; muzzle pale, without a darker dorsal stripe. The range of the Grizzly Bear is considerable, yet not so extensive as that of the Black Bear; it is met with first on the Missouri, above Fort Pierre, and is more abundant higher up the river, particularly on the Yellowstone. Along the region bordering the Rocky Mountains it is common, and extends southward as far as Mexico. A variety from Sonora and the copper mines of New Mexico is described by Prof. Baird as U. horriaceus.

That the Grizzly Bear does not always give chase to Man is proven by Mr. Audubon, in his various accounts. While making an extended tour through the wilds of the eastern regions of the Rocky Mountains, in company with Mr. Bell, of New York (from whom we have heard the narrative), he came upon a large male Grizzly, and, after the members of the party had each discharged several shots, they captured him. On the same day they fell in with another, swimming towards a carcass of a Buffalo, which had caught on a snag in the stream. On seeing the party, the Bear immediately stood erect, as is its invariable habit,

and, after uttering a loud grunt or snort, made a leap into the bushes and gained the upper bank, disappearing as quickly as possible. Several Wolves were waiting near by for their turn, and they, too, slunk away, with their tails between their legs. The Grizzly generally inhabits the swampy, well-covered portions of the districts, keeping a good deal among the trees and bushes, and in these retreats it has its bed or lair. It rambles abroad at night as well as by day. The young and the females hybernate, but the males come forth in quest of food. A den or winter retreat was found to measure ten feet in length, by five feet high and six feet broad. Mr. Audubon's son relates that this animal, if not forced by hunger, will always readily give way to Man—this, of course, always supposing him not cornered; for what beast or living creature will not fight when thus placed?

BLACK BEAR (*Ursus americanus, Pallas*).—The most familiar species in America. It had a range of great extent when the country was first settled. Its flesh is so highly esteemed that even now the creature is hunted with great eagerness; and, in the season, many of our city markets are provided with Bear's-meat. Its fur and fat are well-known articles of value in commerce. The color, and excellent quality of the fur, render it a desirable article for use in the colder portions of the country. The fat of the Bear has long borne a reputation for promoting the growth of the hair; the hard, white fat that is found in the interior of the body being used for this purpose. Whether it possesses any valuable properties or not, it is certainly extensively furnished as an article of commerce. The more innocent swine of the Western States have a reputation for supplying a portion of this demand. The Black Bear is called in some quarters the Musquaw, a term probably derived from the Aborigines. Hunters tell us that Bears have a habit of treading in the same path repeatedly, so that they make a beaten road. This the trappers readily find out, which gives them an easy method of following up their game. During the month of June, Bears are very thin, when their flesh is not esteemed. Then, too, they are engaged in finding their mates, and are particularly savage at such times. The Indians of North America have a custom of trying to propitiate the spirit of the captured and dead Bear. They have a certain respect for the intellectual and physical powers of the animal; they, therefore, deck the head of the carcass with trinkets of various sorts, and lay it, with much ceremony, on a new blanket. Tobacco smoke is then blown into the nostrils by the brave who has slain the creature. A speech is now made by this brave, wherein he extols the courage and other attributes of the defeated animal, says a few words of comfort and praise for its living relatives, expresses extreme penitence for the past act, yet hopes that all may be, on the whole, regarded as satisfactory. This singular custom, though one quite in keeping with the habits of our Aborigines, is not unlike one known to the Scandinavians. A Norwegian speaks with great circumspection of a Bear; he will not use the word that designates that creature, but alludes to him as "the old man with the fur cloak," or as the "disturber."

The habit of hybernating, or sleeping away several months in a retired spot or cavern, is a most remarkable one. It is said that the Bear will not do this unless it is sufficiently fat to exist comfortably without leaving the den until spring. In this cave it gets its living as well as may be outside, exposed to the rigors of winter. It is so entirely oppressed by sleep when hybernating, that the hunter finds it necessary to punch his game before he can take a satisfactory aim. The Black Bear is quite prolific, having from one to four at a birth—going seven months with young. When born the cubs are very small, not exceeding eight inches in length. They remain with the mother until six months of age. The Black Bear was abundant throughout the State of New York, but is now confined to the mountainous districts. Bear-meat was once so common in New York, that the term *Bear-Market* was given to one of the markets of the city, where it was chiefly sold. In those times the price of the pelt ranged from four to twelve dollars, and the oil was one dollar a pound. The food of the Black Bear consists of fruit, insects and small quadrupeds. According to some authors it prefers vegetable food. Audubon, however, considers it as fond of fish diet, and, contrary to the opinion of others, he says that he is positive that it will always select flesh to fruit. In Maine, the lumber-men set traps, with guns attached, and capture the animal in that manner. A funnel-shaped enclosure is constructed by driving stakes into the ground, in two converging lines, with both ends open. The narrow one is just sufficient to admit the muzzle of a gun; the other is broad enough to admit the creature's head and shoulders. The gun is so arranged that it will be discharged the instant the Bear seizes the bait which is attached. The Black Bear is somewhat migratory, moving southwards, in severe winters, in considerable numbers, though singly. They couple in September and October, and almost immediately the females retire to the den. The males, and females that are not gravid, roam abroad in winter, and do not always hybernate, especially if they are not fat. When not fortunate enough to fall in with a dead trunk to ensconce itself, the Bear scratches away the leaves and earth to make a suitable bed, and then lies down to receive the first fall of snow for a covering. Its breath makes a small hole in the snow, which allows a sufficient quantity of air to pass in for breathing. The quantity of hoar-frost which gathers around the opening serves to betray it to the hunter. The specific characters of the Black Bear are: Size small, feet moderate, fore-claws not twice as long as the hinder, color uniform throughout, either black or brownish, the hairs darkest towards the tips. It is found from the northern portions of the continent to Mexico. In California it is replaced by the Grizzly.

THE CINNAMON BEAR (*Ursus cinnamoneus, Bachman*).—This is regarded as a variety of the preceding. The hair is rather longer and softer than that of the Black Bear. The color is a dark chestnut or cinnamon, with purplish reflections.

POLAR BEAR (*Ursus maritimus, Linn.*)—Plate 12, fig. 39.—The NANNOOK, OR WHITE BEAR, is emphatically a marine animal, though not in the same sense as that of the Whale. Its powers of endurance, in the frozen seas in which it freely plunges for its game, are truly astonishing. The rich, silvery coat of this Bear has given rise to its name. His food is naturally of an animal nature, as any other would scarcely sustain the creature. It is a matter of great wonder that the Nannook can pursue with such accuracy his accustomed method of capturing fish. He will plunge into the icy waters, and in a surprisingly short period bring up a fish or young Seal that he has marked for a prize. His sense of smell is very keen; this aids him materially in searching out the breathing holes of Seals. At these apertures the White Bear watches with an intent to seize the first creature that shows a head or limb. He is said to swim under water with great ease, and to approach his prey in this manner, when there is an open sea to operate in. Its endurance is very great: it has been known to swim forty miles in crossing a strait. Though animal food is its appropriate nutriment in its chosen abodes, yet it more readily takes to vegetables and sweetmeats while in captivity. In some of the Zöological Collections it is fed on bread alone. The aspect of the White Bear is unmistakable: its head presents a peculiar shape; the line of profile, from the forehead to the nose, is almost straight; the foot is enormous, compared to that of other Bears, measuring one sixth of the length of the body, while that of the Black Bear is only one tenth. Its flesh is esteemed by those who frequent the northern regions. The Esquimaux assert that the Bear has no evacuations during the period of hybernation. Females that are not pregnant roam abroad like the males, and do not always hybernate. See also vol. i, p. 84.

THE SPECTACLED BEAR (*Ursus ornatus*).—This is the only species inhabiting South America, where its range is over the Cordilleras. It is black, with the exception of two semicircular yellow marks above the eyes, which suggest the trivial name.

FAMILY—MUSTELIDÆ.

Mustela, from the Latin, a Mouse. Pliny made use of this word to designate a species of fish; it was at that time used also as the name of the Weasel. The typical genus now bears that name, and the group of Musteline animals naturally comes under the above family head. Species of this group are very numerous, a recent computation recording as many as ninety-two. They are distributed by late writers, such as Wallace and others, in eight sub-families, three of which have representatives on the American continent. Under the sub-family name *Mustelinæ*, we find arranged the Weasels, the Pole-Cats, Sables, Martens and the genus Galictis. Gulo, the genus which includes the Gluttons, we place with the Bears, in accordance with our plan to change as little as possible the uniformity of this work, the first part being arranged according to the system of Cuvier. Earlier authors have regarded the Glutton as approximating the Bears in many important particulars. The Sub-Family *Melinæ* includes the genera Meles and Arctonyx, Old World Badgers, the African Teledus, and the American Taxidæ, or Badgers. The latter are found under the Family *Ursidæ*. *Mellivorinæ*, or Honey-eaters, as the name imports, are Indian and African Badger-like creatures, some of them called Ratels. *Mephitinæ* heretofore included the American Skunks; these notorious creatures having been preeminently considered so, with reference to their unique secretory functions, and such being so manifestly foul, the sub-family name is particularly apt. The fifth sub-family is *Ictonychinæ*, including the African genera Ictonyx and Zorilla. *Helictidinæ* is Asiatic, with one genus—Helictis. *Lutrinæ* is represented by the Otters, and the Sea-Otters are included in the eighth and last sub-family—*Enhydrinæ*. From the fact that the publications of the Smithsonian Institution will probably long remain as standard works of reference for the student of Mammalia, we adhere to the arrangement of Prof. Baird, which places the *Mustelidæ* of America in three sub-families, viz.: *Martinæ Lutrinæ* and *Melinæ*. Forms in the Family *Mustelidæ* vary considerably; among them are the smallest *Carnivora*, and some, as the Otters, are quite bulky. A striking difference in form is noticeable, for example, between the Skunks and the Weasels. Their food varies in its character; some are omnivorous, others are carnivorous. The absence of a cœcum in the intestines suggests a close relationship to the Bears; on the other hand, they approximate the carnivorous type only through the dental development, which subserves that group. The anal glands are developed to an extraordinary extent, which, in the Skunk of our country and in the Teledu and similar forms of the Old World, have attained the maximum of mephitic potency.

This group of the *Carnivora* is characterized as having, on either side of each jaw, a single tubercular molar tooth only. The sectorial premolar is typical in shape. The feet have five toes, and are plantigrade or digitigrade.

FOSSIL EXTINCT MUSTELIDÆ.

Species of Otter, Weasel and the Badger and Glutton, noticed under *Ursidæ*, occur in European bone caves and other Post Tertiary deposits. In North America a Galictis is found fossil and extinct, the present living species being confined to tropical regions. It occurs also in company with Mephitis in the Brazilian caves. Species of Mustela have been found in the Pliocene of France and of South America, and Lutra in the Pliocene of North America. Five extinct genera have been found in Miocene caves of Europe, called Taxodon, allied to Badger and Otter, Potamotherium, an extinct form of Otter, Palæomephitis, a Skunk-like creature, and forms belonging to existing genera Lutra and Mustela. In Greece was found an extinct genus, now called Promephitis—a form, as the name imports, resembling the Skunks, but preceding it in date of de-

velopment. In the Upper Miocene of Siwalik Hills, North-west India, species of Lutra and Melivora are found, as well as the extinct genera Enhydrion and Ursitaxus. During the Miocene Period there were none in North America, apparently.

MUSTELA.—*Linn.*

The genus Mustela, the typical one of the Sub-Family *Mustelinæ* has thirty-eight teeth, one molar in each upper jaw, and two in the lower. The premolars are four in number on each side, above and below. The lower sectorial tooth has a small tubercle on its inner surface. The body is slender, and the tail is long. The genus includes the Martens, in distinction from the Weasels. They have a large range over the globe, but two only belong to North America. One of these—the Fisher—is the largest of the race, and the other is a close relative of the Pine Marten of Europe.

The teeth are as follows: Incisors, $\frac{3}{3}-\frac{3}{3}$; Canines, $\frac{1}{1}-\frac{1}{1}$; Premolars, $\frac{4}{4}-\frac{4}{4}$; Molars, $\frac{1}{2}-\frac{1}{2}$; $\frac{38}{20} = 38$.

THE FISHER, OR BLACK CAT (*Mustela pennantii, Erxl.*)—This is the largest known species of the family. It is a handsome animal, having quite a resemblance to the Fox; its bushy tail and large size make it an attractive creature. It is, however, one that is less known, probably, than most of our Mammalia. Buffon described this species under the trivial name Pekan. Godman calls it Pennant's Marten. In New York it is known by the hunters as the Black Cat. In Massachusetts it is called the Fisher Weasel. Thirty years ago the Fisher was abundant in the northern portions of the Middle States. It is nearly a nocturnal animal, and lives mostly on small quadrupeds; it also eats fish, frogs, &c., but does not live on fish so exclusively as to give any reasonable color for its name; yet it is best known as the Fisher. It climbs trees easily, and has, in many respects, the habits of the Raccoon. According to Richardson, it bears out its reputation as a Fisher by eating up the dried fish of the natives of the cold regions. The Fisher is hunted regularly in Canada, where it is very numerous, and even troublesome. The season commences about the 10th of October, and lasts to the middle of May, when the furs are not so valuable. The ordinary price is $1.50 per skin. The geographical range is between the fourteenth and seventeenth parallels of North latitude, extending across the continent. It brings forth two young at a birth, annually.

Its specific characters are: Grayish over the head and anterior parts of the body; dark brown or black behind; tail bushy; the largest of the genus; the fur is long, fine and lustrous, increasing in length on the posterior parts of the animal; it is longer and blacker in winter. Audubon regards it as having diminished in numbers greatly, even in the thinly-settled portions of the country. Very little of its history or habits is known or has been written. He occasionally met with it, but says: "With us it is far from a common species." This means more, coming from Audubon, than from any other observer and writer on this subject, for who has traversed, as he has, the wild wood-land, the deep forests, and the mountainous plains, with an eye open to everything that occurs? Audubon was called on one occasion by his servant, rather hastily, to shoot some creature, when it was found to be a fine specimen of the Fisher. He wished to study its habits, and allowed it to remain unmolested. It had climbed to the top of a tall tree, on which a grape vine had entwined itself. He shook the vine vigorously, and teased it in a gentle manner, when the creature became intensely furious. It leaped from one bough to another, showing its teeth, and hissing or growling. Now it would run half way down the trunk, elevating its back like an angry cat. It fell only after several discharges of the gun, showing great tenacity of life. This proved to be a male, and measured twenty-five inches in length; and the tail, including the fur, fifteen inches. On another occasion, Audubon saw a Fisher chase a Squirrel, both passing him, in their eagerness, unconcernedly; they were at full speed, and, in this case certainly, the Fisher would have proved the faster, for nothing could have saved the Squirrel had not a friendly tree intervened, upon which it leaped, and instantly put itself out of reach on the slender branches, finding there a sure haven that the enemy dare not invade, though he unhesitatingly followed as far as he dared go. The Squirrel was so terrified, it did not let well enough alone, but dropped to the ground from the highest part of the tree; the Fisher followed down the trunk; but Audubon was so incensed at this evident attempt at jockeying that he immediately interfered, and saved the life of the Squirrel, which, had the Fisher fairly followed, he would have regarded as fair game. This occurred on a warm morning of July, which is some proof that this animal is not altogether nocturnal in habits. It is not uncommon for other animals, that are regarded as nocturnal in habits during some portion of the year, to go out at mid-day, when pushed by hunger. The hunters say that the Fisher is only taken at night in traps. Lewis and Clark saw it chase the Raccoon from tree to tree, in a long and well-contested run. Richardson says that it feeds much on frogs in the winter, and learns from the backwoodsmen that its favorite food is the Canada Porcupine, which it will kill by biting in its belly—a pretty difficult feat, it should be said, judging from the known habits of the latter. The Fisher is found at the north as far as the Great Slave Lake, at Labrador, and extends to the Pacific Coast. Audubon saw it on the mountains of Virginia. Lewis and Clark met with it at the mouth of the Columbia River.

AMERICAN SABLE (*Mustela americana, Turton*)—Plate I., fig. iii.—THE SABLE of the hunters of New York and other Northern States, resembles closely the Pine Marten of Europe; its fur is beautiful, and is a much valued article of the trapper. Like many others, it is more valuable the further north it is obtained.

The Sable is a very active, pretty creature, inhabiting the elevated and woody portions of the country.

It lives entirely in the forest, differing essentially in this respect from many others of the family that frequent the rocks and open country. It preys upon Squirrels and other small animals. Being nocturnal in habit, it steals forth and robs the birds of eggs, as well as the occupant of the nest of its life. It builds its nest in trees, and brings forth six to eight to a litter. The marvellous fecundity of this creature would naturally secure for it enormous numbers in the regions of its habitat; but the great value of its fur, though subject to the fluctuations of fashion, serves to induce the trappers, and, in consequence, a continual warfare is kept up against it.

Hunters say that the beech-nut, in its season, draws the Sable away from the meat-bait of their traps; but the naturalist, more in accordance with reason, ascribes the diversion to the probable presence of Squirrels, and other small Rodents that are likely to be drawn hither by the abundance of favorite food—the beech-nuts; in these little animals the Sable finds legitimate game, choosing the excitements of the chase. The hunters who are employed in this business set so many traps, which are called, collectively, a "Sable line." This sometimes extends sixty or seventy miles, six to ten traps being placed within a mile. The trap is constructed by driving a series of chips into the ground, to form three sides of a square about six inches across; the top is covered by spruce boughs. The bait—a piece of venison, a Mouse, or the like—is made fast to the end of a round stick, and placed within the trap, resting on a round stick, which lies on the ground across the open end; on this rests a short, upright stick, supporting a heavy log or small tree. Any disturbance of the bait causes the log to fall and crush the animal. These traps are visited once a fortnight, and sometimes oftener, when possible. The traps are so constructed as to protect, in a measure, the captured animal from the attack of larger Carnivores; but they are not unfrequently broken down and robbed of the contents.

The specific characters are seen in the general color being reddish-yellow, with a black clouding; above, it becomes lighter towards the head, which is sometimes white; a broad, yellowish patch is on the throat, widening below so as to touch the legs; the central line of the belly, in some instances, yellowish; legs and tail are black; the feet are densely furred.

The Pine Marten is shy, cruel and cunning. Dr. Godman says that it enlarges the nest of the Squirrel, after destroying the occupant, and takes possession, thereby taking the benefit of the labors of the weaker. When irritated, the Marten arches its back and makes a hissing noise like the Fisher.

PUTORIUS.—*Cuvier.*

This genus is constructed to admit a few species that differ from the preceding Mustela in having one molar less on each side, above and below. Individuals are generally larger, and the body less slender, than in the typical species. They have thirty-four teeth: one molar above and two below; the premolars are three on each side, above and below; the lower sectorial tooth has no inner tubercle; the tail is usually long.

Many of the species are peculiar to this continent. Three distinct groups are recognized, which exhibit sufficient differences to suggest nearly a generic subdivision. In the Putorius proper the body is stout, and the under surfaces are darker than the sides. There are none of this group in America. Another, to which the title or sub-generic name Gale has been applied, has the body very slender and elongated; the fur is lighter below than above and on the sides; the naked pads on the feet are small, and more or less hidden by hair. This group contains all the Weasels of America, except the Minks. The Putorius nigripes of Audubon and Bachman is considered doubtful, and holds an uncertain position at present. The third, Lutreola, has the color nearly uniform all over; the feet are webbed very perfectly, their naked pads being large, and uncovered by the hairy soles; the intervals between the metacarpal and the metatarsal pads are not occupied by hairs; the posterior upper molar is longer than in Gale. The Mink, which so resembles the Otter, is of this group.

The dental formula of the true Weasel is: Incisors, $\frac{3}{3}-\frac{3}{3}$; Canines, $\frac{1}{1}-\frac{1}{1}$; Premolars, $\frac{3}{3}-\frac{3}{3}$; Molars, $\frac{1}{2}-\frac{1}{2}$; $\frac{16}{18}=34$.

LEAST WEASEL (*Putorius pusillus, Aud. and Bach.*)—This is the smallest of the North American species. It is distinguished by its size and extremely short tail, the black tip of which, so constant in other species, is absent here. It is very similar to the P. vulgaris of Europe, but is smaller. It was for a time considered as the same. Dr. Godman, on the authority of Bonaparte, describes it as Mustela vulgaris. It is even considered generically distinct by some authors. Though rather a common animal in the colder portions of America, it is not easily captured, and is, consequently, not a familiar one. Most people know what a Weasel is, but few have really seen them. It feeds on mice, young birds, insects, &c. If the present species has anything like the habits or temper of the European that it so much resembles, it must be a truly formidable creature when thoroughly angry. Tales are told of individuals following a person, and actually seizing him by the throat, and inflicting a severe if not fatal wound. The predacious birds, even, are not safe in attempting their capture. Cases are known where a Hawk, that had seized for its prey a Weasel, was seen to waver, and eventually fall dead, now the victim of the creature that its powerful claws but a moment before clutched so securely. The Weasel had bitten through the neck of the bird, and sucked its life-blood. Such wonderful agility is exhibited by this creature as to challenge our admiration. One has been seen to spring at and capture a Bunting on wing. Even Partridges have been brought down, just as they were rising. A curious incident is related of a Crow and a Weasel, each at the same time watching the coming forth of a laying hen; the exultant cackle of the latter was a signal for both enemies to charge, but the Crow

always won. There is a show of audacity and courage in this little thing, which would be absurd were it not backed by real and serious results. It attacks Man with as little hesitation as it does a Mouse. Instances are known where they have united several in a group, and attacked a horse and rider. As savage as the Weasel appears, it is often tamed, and becomes a safe and interesting pet. A lady gives an account of one that seems to have become, to her, as completely tamed as a Cat or Dog. She says: "In the midst of twenty people this little animal distinguishes my voice, seeks me out, and springs over everybody to come to me. With his two little paws he pats me under the chin with an air and manner of extreme delight. He also played with a Cat and Dog with equal familiarity." Other instances are recorded of this species being tamed.

The specific characters are: Color same as in P. noveboracensis in its summer coat, but smaller; unchanging; tail one fourth of the whole length; length twelve to thirteen inches. It remains brown throughout the year in the United States. Sir John Richardson states that it changes to white in the northern regions. Prince Maximilian states that this species is white in winter, but does not say in what locality. Fine specimens that were obtained by the prince in America are now in the collection of the American Museum, New York.

SMALL BROWN WEASEL (*Putorius cicognanii, Baird*).—This is regarded as one of the most easily identified and strongly marked species. It is nearer the pusillus, yet distinguished by its longer tail and black tip. This Weasel seems to be common in Massachusetts, but its geographical range is not well established. It is characterized by being brown in color above and white beneath. The tail is one fifth of the whole length. The feet have long hairs. Its length to tail is about eight inches; tail vertebræ, one third of this. Two fifths of the tail is black. The form is rather more robust than the preceding.

RICHARDSON'S WEASEL (*Putorius richardsonii, Baird*).—This is a little larger than the preceding. It is found in much the same localities. The hairs do not form a brush on the tail, as in some species. The feet are much smaller, more delicate and slender than in P. noveboracensis; though actually larger in body, the feet are relatively smaller than in P. cicognanii; the tail, of course, is considerably longer; the ears are higher and narrower at the base than in the last-mentioned species. It is readily distinguished from P. cicognanii by the longer tail, the vertebræ alone of which are half the length of the body, instead of requiring the entire tail to effect the same proportion. It is much smaller and darker than P. noveboracensis, and the whole upper lip is brown.

Specific characters: Length of body to its tail, nine inches or less; the tail vertebræ about half this length; the black of the tail is one half or two thirds its length. In summer, it is a dark chestnut-brown above, whitish beneath; whole upper jaw brown, in winter white. The tail has a black tip.

COMMON WEASEL (*Putorius noveboracensis, De Kay*).—WHITE WEASEL is another name for this species; and De Kay has described it as the New York Ermine. Pennant calls it Stoat Weasel, from its apparent affinity with the English Stoat. Harlan has it the Mustela erminea, and Godman the Ermine Weasel. Among the trappers it is called Catamingo. This Weasel is found as far south as Pennsylvania, and specimens have been found in Wisconsin and Arkansas. It is not known north of Massachusetts, but is probably distributed throughout the Southern and South-western States. Compared with P. cicognanii, its longer tail and larger body will at once distinguish it. Compared with the Ermine of Europe —P. erminea—it is decidedly different. The most striking variation is in the tail, which, including the hairs in P. erminea, is about as long or a little longer than half the body. The hairs on the extremity are very long and bushy. This Weasel, it is thought, does not change its color, remaining brown throughout the year as far north as Massachusetts. There seems to be some doubt expressed about its being white at all in winter, in any latitude.

THE LONG-TAILED WEASEL (*P. longicauda, Rich.*)—This is a larger species, its length to tail being about eleven inches, the tail vertebræ being about half this length; the black of the tail is about one fourth of the length. The color of body above is a light olivaceous-brown, with a brownish-yellow beneath; the edge of the upper lip and chin is white; in winter it is pure white throughout, the tail with a black tip. The light space on the belly is much wider than that of P. noveboracensis. Muzzle is broad. Baird, in *Pac. R. R. Rep., Zöology*, says: "This species, which belongs to the section of Ermine Weasels, is larger than any of its congeners, excepting the American Ermines. Like the P. nigripes of Aud. and Bachman, it is characterized by the breadth of the muzzle, as very distinctly shown in the skull. The hair is, even where remarkably stiff, coarse and short, much like that of the P. frenata." It is doubtful whether it changes its color in the colder months.

KANE'S ERMINE (*Putorius kaneii, Baird*).—This is from the regions of the north west, and is said to be a perfect miniature of the Old World Ermine. It has been named by Prof. Baird for the lamented Kane, the medical officer of the first Polar Expedition sent out by our country in search for Sir John Franklin. In this connection Prof. Baird says: "As the most Arctic mammal it may ever be my privilege to name, and especially as an Ermine, emblem of spotless purity and integrity, I propose to call it after Dr. Kane, the devoted martyr to the cause of science and humanity, and thus impose upon it an appellation which will be understood and appreciated in whatever portion of the world this description may be read."

The specific characters are thus given: "Length to tail about eight and a half inches; tail vertebræ about one sixth this length; black of tail one half the total length. In summer brown above, edge of upper lip, whitish; in winter white, tail with black tip. The fur is soft and fine; above, of rather a dark chestnut-brown; beneath, sulphur-yellow. The under

part of the head, and a wide margin to the upper jaw, are white. The feet are yellowish-white, but there is no white about the ears. Compared with summer specimens of the Ermine from Northern Sweden, the size is much less; the tail, perhaps, a little longer; the terminal hairs shorter; the black tip less extensive, occupying not more than half the total length, instead of nearly two thirds. The end of the vertebræ falls considerably in advance of the posterior third of the black tip, instead of considerably behind it, as in P. erminea. The winter specimen differs in about the same characters. The animal is about the size of the American P. cicognanii, which it otherwise greatly resembles and represents. The tail is, however, shorter, thicker, and the terminal hairs are longer. The black tip occupies, likewise, a larger portion of the tail."—*Baird.*

BRIDLED WEASEL (*Putorius frenatus, Aud. and Bach.*)—This species is readily distinguished from other American forms, except P. xanthogenys, by the curious patch of yellowish-white on the forehead, and another anterior to each ear. It is quite abundant around Matamoras and Brownsville, Texas, but is not known farther north.

YELLOW-CHEEKED WEASEL (*Putorius xanthogenys, Baird*).—This is peculiar to the California Coast. It is closely allied to P. frenatus in general characteristics, in tint and pattern of coloration. The ears are rather more acute than in the last species, and not so broad at the base. The toes are longer, and less fully webbed; the under surfaces of all the feet are more densely furred. As its name indicates, it has three patches of yellow on the cheeks. The upper parts and sides are a chestnut-brown; a dull brownish on the belly; a paler tint is on the chin; there is a yellow spot on the top of the muzzle, anterior to the eye, and a patch of the same commences acutely about midway on the edge of the upper lip, and passes in a sub-crescentic direction behind the eye, about half way between it and the ear, though not getting as high as the upper edge of the latter; the whole space between the ear and the border, just described, is occupied by this color; there is a dusky spot on each side of the lower jaw; the upper part of the head is a little deeper in color, though far from having the intensity of P. frenata; the tail is like the back, dusky at the tip.

COMMON MINK (*Putorius vison, Gapper*).—This is the most familiar species in our North-eastern States, and is found in every farm-yard, oftentimes much to the annoyance of the farmer. It is a true Weasel, though it does not altogether resemble the smaller species. The popular term Mink is said to be corrupted from the early Swedish *Mœnk*. The hunters recognize two varieties—the Mountain Mink and Water Mink. It lives exclusively near ponds or rivulets, feeding on fishes and mollusca. In habits, it resembles the Otter. Pennant regarded it as so like, that he called it the Lesser Otter. It swims and dives with great facility, and has the power to remain submerged a long time. It has a very offensive odor, likened by some to a mixture of that of the Cat and Skunk. The fur of this species is at times in great request as a fashionable winter article of dress. The specific name lutreola was given it by Forster, in token of its Otter-like resemblances. It is the Mustela vison of Brisson, Cuvier, Harlan, Maximilian, Scrieber and Gmelin; Mustela (Putorius) vison of Richardson; Lutra vison of Shaw. Putorius lutreola of Europe is smaller than our species, and has the edges of the upper lip white, which never occurs on the American Mink.

LITTLE BLACK MINK (*Putorius nigrescens, Aud. and Bach.*)—This is not thoroughly established as a distinct species, though it appears under the above title in Audubon and Bachman's work. Prof. Baird reluctantly admits it, without having had an opportunity to determine the matter by an examination of a sufficient number of specimens. It is the species that furnishes the best fur of the Mink, being nearer the Russian Sable in quality than any other. In size, it is smaller than the common variety, with a chestnut-brown color, glossed with black. The tail is almost entirely black; the end of the chin is white. Specimens are found in Massachusetts and as far west as Kansas.

BLACK-FOOTED FERRET (*Putorius nigripes, Aud. and Bach.*)—Audubon and Bachman describe this species as of the size of the Pine Marten; tail, with hairs, one third the whole length of head and body; forehead, feet and end of tail, black; body yellowish-brown above, white beneath.

PERUVIAN WEASEL (*Mustela agilis*).—For want of a better common name, we adopt the above, no other being recorded, as far as we have seen. The term *agilis* can hardly be assumed to be distinctive of habits, as no mention is made of this species being more fleet or sprightly than others. It would seem, then, appropriate enough to call it the Peruvian Weasel, inasmuch as it is said to be the only species found in South America. "M. agilis (not of Audubon and Bachman) is very slender in form, with a small and pointed head; the tail much shorter than the body. The head, back and tail are reddish-gray, the latter a little darkish at the tip; the under parts generally are grayish-white; the base of the hairs above is gray; then follows a broad, grayish-yellow ring, succeeded by a reddish-brown tip; the head above is either entirely dark brown, or with a white border to the upper lip. The length of body to root of the tail is 9.10 inches; the tail, $4.4\frac{3}{4}$ inches; the head, $1\frac{5}{12}$ inches. This species, a true Putorius, differs materially from the larger North American Weasels in the absence of a black tip to the short tail—in this respect, resembling the P. cicognanii. It probably bears a near resemblance to P. boccamela of Italy. The lack of white or yellow blotches on the forehead distinguishes it from either P. frenata or xanthogenys. It inhabits the cold and barren plateaus of the Peruvian Cordilleras, and is the only true Weasel well established as inhabiting the southern half of the continent."—*Baird.*

The P. agilis was described by Tschudi in his *Fauna Peruana*, 1844–6.

SUB-FAMILY—LUTRINÆ.

Otters are here indicated; Lutra, the old Latin name for the same, being expressed in the sub family designation. They resemble very closely, in their typical aspect, the Minks, but, in the form of skull and teeth, approach nearer to the Skunks. The body is notably long, the feet are short, and the toes are webbed. They are all large, and are amphibious. Three genera are recognized—Lutra, the typical form; Pterura, confined to South America; and Enhydris, which includes the Sea Otters. Baird gives the following as the sub-family characters, viz.: "*Mustelidæ*, with the posterior upper tubercular molar large and quadrate. Number of molars the same in each jaw. Feet short and palmated."

LUTRA.—*Linn.*

This genus has an extended distribution, every quarter of the globe having a representative. The absence of marked colors, and a general resemblance among the species, renders their classification very difficult. The more prominent features are seen in the naked muffle, the more or less palmated and hairy feet, the details of skull, &c. A thoroughly marked species is found in the Lutra canadensis.

The skull of the Otters, in general, has some resemblance to that of the Martens, but is more depressed and more contracted behiud the orbital processes. The top of the skull is nearly straight, and almost parallel with the margin of the lower jaw. The generic characters are seen in an elongated body; short and palmated feet; distinct digits, with a longer central one; a tail moderate in size, depressed and rounded on its sides. The dental formula is: Incisors, $\frac{3}{3}$–$\frac{3}{3}$; Canines, $\frac{1}{1}$–$\frac{1}{1}$; Premolars, $\frac{4}{3}$–$\frac{4}{3}$; Molars, $\frac{1}{2}$–$\frac{1}{2}$; $= \frac{1}{1}\frac{8}{8} = 36$.

NORTH AMERICAN OTTER (*Lutra canadensis, Sabine*).—The Otter was once numerous in the Eastern States, as well as in other parts of the country, but is now exceedingly scarce. In the extreme northern districts it is yet hunted for its fur, which ranks in value next to that of the Beaver. It is exceedingly shy, building its place of abode on the banks of some running stream, where it is secure from intrusion, and where it may readily take to the water, in which it seems more at home than on land. Its burrow is so constructed that an opening is had under water, and a small breathing hole communicates through the soil of the bank with the open air. It is quite as sagacious as the Beaver in its avoidance of the trap, and the trapper has to resort to sinking the steel implement under water, beneath the opening of the burrow or at the bottom of one of their "*slides*." The "*slide*" is a most remarkable result of habits peculiar to Otters. In winter, they select a high bank of snow, and amuse themselves for hours in sliding down headforemost. In summer, they choose a steep bank by the side of a stream, which terminates in deep water, and here they indulge in the same recreation. This would seem to be incredible, but there are ample evidences of its truth. Audubon confirms this, and relates an instance of seeing two Otters engaged at this trick, and that they made twenty-two slides while he looked on. They live in small families, like the Beaver, bringing forth two young at a litter, about the middle of March. The period of gestation is not known. In baiting the traps, the secretion from the anal gland is used to attract them. In streams stored with fish in abundance, the Otter is sure to take up his residence, and here he creates great havoc. Not content with a modest meal, or a sufficiency, he must gratify his pleasure. In his love of fishing, he destroys many more fish than he can eat, by taking a bite from the choicest morsel, and leaving the carcass to some less fastidious creature. In seasons when the streams are not accessible, the Otter invades the poultry-yard, and proves a formidable marauder. The Otter has been tamed, and proves a gentle and inoffensive pet, notwithstanding its extreme ferocity when wild. The Chinese make use of Otters, and it is said that they are as common in the East as trained dogs in other countries. A systematic method of instruction is adopted by the Chinese, which results in their being of great use to their masters. They not only catch single fish, but are trained to drive whole shoals into the nets. Two half-grown Otters were kept, during the winter of 1877, at the New York Aquarium, where they offered an excellent opportunity to the naturalist to study their habits and living aspect, and the public, amusement, and a chance to become acquainted with an animal seldom seen alive in the settled parts of the country. In the water, the Otter glides swiftly and gracefully, and with so little disturbance that it easily captures its prey before it is alarmed. Their fur is in great request; there are two kinds—one is close, fine and soft, lying next to the body, rendering the creature a warm clothing in the cold season; the other is a long, shining and coarser hair. In preparing the fur for the market, the skin is scraped on the iuside, so that the longer hairs, which actually protrude farther into its substance, are loosened, and then drawn out by a vigorous brushing. Audubon gives entertaining accounts of Otters, having had considerable personal experience with them. He says: "It is a cold winter morning. We see a dark object making its way towards the spot on which we stand, through the swiftly-dividing element. It has not observed us. It is an Otter, and now within range of our old gun '*tear jacket.*' We take but a moment to aim and fire. The water is agitated by a violent convulsive movement of the animal. Our dog plunges into the river and, swimming eagerly to the Otter, seizes it; but the latter dives, dragging the dog beneath the surface, and, when they reappear, the Otter has seized the dog's nose, who struggles violently. The brave fellow does not give it up, but eventually drags the Otter to the shore, where he is soou dispatched." Audubon also observed Otters near Henderson, Kentucky, "on the borders of a beautiful pond, lined with reeds and brakes. Here were Otters engaged in catching and devouring fishes. When pursuing a fish, they dived handsomely and expertly, occasionally remaining under water

more than a minute. They generally held their prey, when they came to the surface, by the head, and almost invariably swam with it to a half-sunken log or to the margin of the pond, to eat the fish at leisure." He found them at another locality, several living together in an old dead stump. The trunk of the tree was so hollow that it communicated with the water, and the Otters had easy access to it under the surface of the stream. Audubon visited Cooper River to see the Otters that were, at that time, very numerous there. He counted, on the morning of his visit, forty-six, as they were swimming down with the tide, in groups. At the mouth of the river they separated, and each pushed on up the various creeks to catch Mullet. When the tide rose again, they all swam back up the river, to return to their customary retreats. He also tamed several Otters, and corroborates the stories related concerning their docility, and even affection—in the latter respect seeming more like that of the Cat; his pets being in the habit of climbing into his lap, and having free range of his library. This species is the L. lataxina of Fred. Cuvier; L. vulgaris var. canadensis of Wagner; Lataxina mollis of Gray; the same of Gray in Aud. and Bachman (*N. A Quadrupeds*); Lutra braziliensis, Harlan; Lutra hudsonica, Fred. Cuvier, in *Supplement to Buffon*, 1831. The specific characters are indicated as follows, viz.: Its length is about four and a half feet. The muzzle is longer than wide, with a naked point along the medium line of the upper lip anteriorly. The under side of the feet, near the circumference, is covered with hair, sufficiently to isolate the naked pads of the tips. A hairy strip extends forward from beneath the carpus on the palm. The color above is liver-brown, barely lighter beneath; the under surfaces, and sides of head and neck, a dirty-whitish. The body is low, depressed, and the legs are short. The feet are webbed to a point opposite the root of the claws. Considerable difference of opinion has been expressed concerning the existence of more than one species of Otter in the interior of the United States. "The differences between the European and American Otters," says Prof. Baird, "are very appreciable, both in the external form and the skull, the most striking peculiarity of external form in the European being the small size of the naked muzzle, as compared with the American."

CALIFORNIA OTTER (*Lutra californica, Gray*).—This very closely resembles the Otter of the Eastern States. A comparison of it with the L. canadensis, by Prof. Baird, gives the following differences: The naked muzzle is decidedly shorter, antero-posteriorly, the width remaining the same. Length of the naked portion is less than its width, instead of being greater, as in L. canadensis. The angle of the posterior outline is, consequently, less acute, and is shorter, not running so far back on the forehead. The septum of the nostrils is narrower, and there is no naked point running down from its middle line, and partly bi-secting the middle of the upper lip, as in the canadensis. Both of our species are distinguished from L. vulgaris of Europe by a great development of the post-orbital process of the frontal bone, broad inter-orbital space, very broad and short muzzle, &c. Its specific characters are given as follows: Length of body about four and a half feet. The naked muzzle is wider than long, no naked point being sent down from its anterior edge. The under surfaces of all the feet but slightly hairy; the naked terminal pads not isolated from the other bare portions by hair, except in the central digits of the fore-feet; the naked portion of the palm not invaded by hair from the carpal region. Color above is liver-brown, the long hairs with lighter tips; not appreciably lighter on the belly; sides, and under surface of the head and throat, dirty-white. The ears in this species are very small, pointed, and higher than broad; the hind-feet are rather larger than the fore, but the fingers are proportionately the same.

ENHYDRA.—*Fleming.*

This genus includes only one species. Its characters are seen in a fin-like shape to the fore-feet, the anterior ones four-lobed; the lobe next to the outer is the longest, having two claws above; the hind-toes become shorter from the fifth to the first. The skull and teeth differ materially from the true Otters. The first small premolar of the upper jaw, on either side, is wanting, the total number being less by two, or thirty-four in all.

SEA OTTER (*Enhydra marina, Fleming*)—also called KALAN in the northern regions.—This is a very much larger animal than the land Otters, and, in its habits and general appearance, rather resembles the Seal. It is an inhabitant of the Pacific Coast, in both hemispheres; reaching, on this continent, as far south as Monterey. The fur is of exquisite brilliancy, shining with a glossy velvet-like sheen; it is valued moderately, but sufficiently so to cause a gradual scarcity, through the constant warfare made on this animal by trappers. The Sea Otter has a habit of leaving the coast when summer commences, and, in company with its mate, proceeds up the river until it reaches the fresh-water lakes of the interior; there it remains until the cold season commences, when it returns to the open sea, where it is not likely to be deprived of means of subsistence. There seems to be a special adaptation of the limbs of this creature for swimming, and an almost continuous life in the sea, differing in this respect from the land Otters, which are quite capable of living out of the sea. This is the Lutra marina of Steller, Godman, Harlan, Wagner, Demarest and Erxleben; Latax marina of Lesson; Mustela lutris of Linnæus and Gmelin; Phoca lutris of Pallas; Lutra lutris of F. Cuvier; Enhydris stelleri of Fischer, and E. gracilis of the same.

SUB-FAMILY—MELINÆ.

This group, according to later arrangement, embraces the Skunks and several genera that we have, according to the Cuvierean system, placed with the Bears. The genus Meles represents the European Badger; and Mydaus, Helictis and Arctonyx are Asiatic forms; Taxidea and Mephitis being peculiar to America.

FOSSIL EXTINCT MELINÆ.

In the bone caves of Europe are found several fossil and extinct forms allied to this family. Meles antidiluvianus is one that has been recorded and named. Another genus, called Palæomephitis, has been discovered in the fresh-water calcareous beds of Steinhein.

MEPHITIS.—*Cuvier.*

The mephitic or bad odor resulting from the secretion of peculiar glands in these animals, suggests the generic name. The sub-family name—from Meles, the Latin for Marten—has a more general signification. The *Mustelidæ* are *all* in bad odor, they all have odoriferous glands, more or less potent or disagreeable; but the Skunks!—"And smelt so, pah!" Lichtenstein has established two groups, which he regards as exhibiting well-marked differences. Thiosmus he establishes as having the upper incisors linear, the outer stronger and longer than the intermediate ones, the lower equal, with a longitudinal groove in the posterior face. There are three upper molars on either side, and five on the lower, the anterior sometimes deciduous. The naked muzzle is depressed, projecting, and with nostrils on the under surface; the soles are broad and naked; the tail moderate in size. Mephitis he regards as having nearly equal upper incisors, the outer one being a little stouter. There are four upper molars on each side, and five on the lower jaw, the anterior being always persistent. The snout is prominent and not depressed, and the nostrils are laterally situated. The soles are somewhat narrow, and partially or entirely hairy. All the North American species belong to the latter, excepting the M. mesoleuca, which is a Thiosmus. In treating this subject, Prof. Baird adds: "J. E. Gray, in *Charlesworth's Mag. of Nat. History*, 1837, vol. i., p. 581, establishes two genera—Conepatus and Marputius—the latter of which, to some extent, covers the ground of Thiosmus, and anticipates it in point of date. Though objectionable in some respects, a strict regard for the law of priority may cause it to be retained. The species of these two divisions of Mephitis belong to America exclusively, and extend throughout both halves of the continent. Several are peculiar to Mexico. Of Thiosmus, two are Mexican, one of them extending into the United States. All the rest are South American, where the restricted Mephitis does not occur."

WHITE-BACKED SKUNK (*Mephitis mesoleuca, Licht.*)—This was first described by Lichtenstein from a specimen brought from Chico, in Mexico, and is one of his genus Thiosmus. Audubon says that it is quite common in Texas. Its geographical distribution has not been fully determined. The specific characters are: A broad, uninterrupted band of white, beginning abruptly at the nape as a transverse straight line, and occupying the entire back to the tail, which also is entirely white; the body is entirely black, excepting the white dorsal stripe. It is regarded as similar to M. leuconota of Lichtenstein, but is much larger, has a longer tail, and differs in having much less white. Its length is seventeen inches, the tail about twelve inches. Bennett describes the same species as M. nasuta, and Lessing the same as Thiosmus nasuta.

TEXAS SKUNK (*Mephitis varians, Gray*).—This is another Texas species, said to be abundant there. It is the M. macroura of Audubon. The specific characters are seen in a full and bushy tail, which is attenuated and pointed at the end, where the hairs are long. The vertebræ of the tail are the same length as the body. Its color is black, with a narrow, white frontal line. A white nuchal patch, broad and truncated anteriorly, extends between the ears, then passing backward, narrowing a little, to between the shoulders, where it bifurcates narrowly, the branches passing along the sides to the hind legs; another narrow white stripe on either side commences within the termination of these, and runs out on the posterior half of the tail. The tail is black, the hairs on the basal half being white; on the middle of the tail, there is a patch on which the hairs are white to the end. Its length to the root of the tail is fifteen inches; the vertebræ measures fifteen inches, and the terminal hairs three and a half.

CALIFORNIA SKUNK (*Mephitis occidentalis, Baird*).—This is a large species, inhabiting the region about California, where the two preceding species are not known. It resembles M. varians, excepting that it is much stouter, with stronger and broader feet; the tail, also, is much shorter, being entirely black externally, instead of a patch of white in the central parts. The skulls differ somewhat. Professor Baird gives the specific characters as follows: "In size, that of a Cat. Tail vertebræ two thirds the head and body. Bony palate with small, narrow emargination in the middle of its posterior edge. Color black, with a white nuchal patch bifurcating behind and reaching to the tail, which is entirely black. The feet seem to be a notable character in this species, being exceedingly large and broad."

THE SKUNK (*Mephitis mephitica, Baird.*)—Plate 10, fig. 33.—This is *the* Skunk *par excellence*, the mephitic Mephitis, literally and emphatically, according to the text. To a portion of our readers, it were superfluous to call attention to the renowned attributes of this creature. To the rural denizen, it is one of the salient objects of his earlier memories; to him, its possibilities are unutterable, its consequences ineffaceable. With all its demerits, however, the Skunk is not without certain admirable qualities. It is handsome—notwithstanding the poet saith, "Handsome is that handsome does"—and it is gentle as a kitten. Mr. John Bell, the eminent taxidermist, has given a very interesting account of the capture and taming of a litter of young Skunks. Mr. Audubon studied these specimens, and made from them the figures found in his large work, the *Quadrupeds of North America*. The glands were removed from these little creatures early; consequently, they were handled with entire impunity, and proved to be interesting pets. Mr. Bell says that they exhibited from the earliest moment a tendency to turn and assume the attitude requisite for a discharge of the

glands, and continued to do this even after the removal of the latter. The fur of the common Skunk is long, and strikingly and pleasingly embellished by an alternation of black and white stripes. When seen at night—for it is crepuscular or nocturnal in habit—especially on a moonlight night, it seems either conscious of its latent powers, or is essentially good-natured, showing less fear even than the domestic Cat. We have seen one walk deliberately along the middle of a town street, its tail erect, flowing like a fountain plume. It will suffer you to approach, and the unwise or inexperienced may, most likely, be impelled to catch it. In most instances the attempt is rewarded with complete success—in the Pickwickian sense. Macbeth's soliloquy is here exactly reversed, for it is the *deed* and not the *attempt* confounds us. See also vol. i., p. 86.

LITTLE STRIPED SKUNK (*Mephitis bicolor*).—This is the smallest of American Skunks, and is particularly handsome in the disposition of the black and white marking of its fur. In length, it is only about that of the Weasel, though stouter in body. Its nose is long and pointed, the nostrils being situated on the sides. The body is black, with an irregular four-sided figure on the crown of the head. On the base of the ear, forward, is a crescent shape of white. Four parallel stripes run lengthwise of the body; two narrow ones commence at the occiput, separated a half an inch, and one on either side of these, broader, and closing in with the lower edge of the crescentic patch of the face, extending along the middle of the sides; another stripe on each side begins on the side of the belly, behind the axilla. These stripes are all continuous until they are interrupted on the middle of the body. Four spots now replace the stripes, and they are sometimes so placed as to resemble stripes transversely across the flanks. The hairs of the tail are entirely black, except the terminal portion of longer hair, which is white.

Mephitis mesomelas.—This species has no trivial name, and its specific designation does not seem to be particularly distinctive. Its characters are recorded as follows: From the nose to the vertex there is a narrow, white band and a nuchal spot, truncated anteriorly, divided behind into two, extending along the sides of the back and tail. The short fore-claws, and the densely hairy soles of the feet are characters that distinguish it sharply from others. Lichtenstein, who first described it, and gave the locality as Louisiana, gives the length as nineteen inches, the tail being nine.

Mephitis leuconota.—This is another species described by Lichtenstein, as coming from the River Alvarado, Mexico. Its characters are seen in a white stripe, which runs the length of the back, widening about the middle, coming to a point at the vertex, contracting at the posterior, and ending at the terminus of the tail. Its length to root of tail is twenty-four inches; of tail, twelve inches. The stripe in the middle of the back is three inches in width.

Mephitis macroura.—Another Mexican species, also described by the same author as the preceding. It is recorded as being found in the more temperate regions of Mexico. On the head is a broad patch of white, which is continued behind into a broad stripe over the body and tail. On the sides is a single longitudinal white stripe. The length of the body is fourteen inches; of the tail vertebræ, thirteen inches; its terminal hairs, five inches.

Mephitis vittata.—In Oaxaca, in Mexico, Lichtenstein discovered this, and gives the following specific characters: From the nose to the vertex a narrow line; one or two streaks on each side, along the occiput; a solitary stripe on each side, from the parotid region to the base of tail. Body thirteen inches; tail vertebræ eleven; terminal hairs four inches.

GALICTIS.

This genus, as recorded by Mr. Bell, is characterized by having eighteen molar teeth, ten being spurious. On the upper jaw are four, and on the lower, six. For a more particular account, see vol. i., p. 87.

THE GRISON (*Galictis vittata, Bell.*)—Fig. 23, vol. i., p. 88.—This is a native of Brazil, Paraguay and Chili, and is also common as far south as Patagonia. It is regarded as a particularly fierce creature, even in captivity and domestication. Fred. Cuvier relates an instance of the Grison's ferocity: "One that had been kept in a state of domestication, and well fed, became so enraged at a Lemur that it fell upon it and soon killed it, breaking the bars of its own cage to reach the unfortunate quadrumane. Yet it was gentle and docile in play, seizing the hand of its master in mock attempts at biting, yet never inflicting a wound. Its memory was quite striking, as it always remembered those that fondled it, and allowed considerable familiarity for those that petted it gently. Its odor is a great drawback, however, to its being kept as a pet. This is the Viverra vittata of Schreber; Gulo vittatus of Desm, Rengger and Fischer; Ursus braziliensis of Thunberg; Le Grison of Buffon; El Huron menor of Azara. It is called Grison, Huron and Quiqui in Chili, and Cachorino de Mato in Brazil.

THE MAIKEL (*Conepatus amazonica, Gray*).—Gray describes this animal in the *Magazine of Natural History*, London, and mentions a variety under the specific name humboldtii. Lichtenstein called it Mephitis amazonica. Its habitat is in the Straits of Magellan.

THE PATAGONIAN MAIKEL (*C. humboldtii, Gray*).—This is recorded by Gray in the *Catalogue of the Mammals in the British Museum*, under the above title, though at one time he regarded it as a variety of the preceding. These animals are not often seen, and very little is recorded of their habits.

THE TAYRA (*Galera barbara, Gray*).—This genus has this solitary species only. It is known as the GREAT WEASEL by Azara, who described it. Its habits are not well known, though it has been kept for a time in captivity. It is said to be extremely lively and amusing, uttering a kind of voice which

resembles somewhat the call of a hen to her chickens. It is about the size of the common Marten, and in color is a uniform black, slightly tinged with brown, with the exception of a large white patch, which covers the throat and upper portion of the chest. It is said to burrow in the ground for its breeding retreat. Linnæus called it the Mustela barbara; and it was known to Prince Maximilian as Mustela gulina; to Erxleben as M. galera. Illiger calls it Gulo canescens; Retz and Desm, Gulo barbatus; Trail, Viverra poliocephala; Schreb, Viverra vulpecula; Brown and Buffon, Galera subfusca. It is found in the Brazils and various parts of tropical America. Three varieties are mentioned by Gray, one as having the head and shoulders gray-brown, another with head grayish, and a third having a dark grizzled head. Two extinct species of Galera are found in the Post Pliocene of North America.

FAMILY—VIVERRIDÆ.

This family is represented in America by only one genus, and one species only of that genus. One hundred species are enumerated by Wallace as inhabiting the Old World. One species, the Genette, is indigenous to the southern part of Europe. They are mostly animals of a medium size, with a slender and elongated body, a pointed muzzle, and a long and annulated tail. Most of the species have hairy soles, while in others they are bare. Their walk is plantigrade. They have the two anal glands of the *Mustelidæ*, with others in the anal and pubic regions peculiar to them. The African form, the Civet Cat, furnishes to commerce the well-known musky matter, called Civet, a secretion from some of the peculiar anal glands. Dr. Gray has a careful revision of the *Viverridæ* in *Proc. Zoöl. Soc.*, London, 1864, in which he divides the group into thirty-six genera. Two prominent sub-divisions of the group include the Cat-footed and the Dog-footed, so called by the same author. The former are represented by the Civets and the Paradoxuri. The latter are queerly denominated such from some fancy of an observing naturalist that the individuals of the group have a way of exhibiting their tails in extraordinary contortions; hence the two terms, *paradox* and *urus*—"unexpected tailed." The other group includes the Ichneumons. Fossil remains of both groups have been found in Miocene strata in the south of France. The Ictitherium is one genus found in the Miocene of Greece. Soricictis, Tylodon and Palæonyctis are other extinct genera found in the same localities.

AMERICAN CIVET (*Bassaris astuta.*)—Fig. xii.—This being the only creature in America at all in affinity with this family, it is most certainly appropriate to call it as above. The Mexican terms Cacomixle and Tepemaxthalon are local, and less distinctive. Bassaris, from the Greek, indicates a supposed resemblance to the Fox. In Mexico and California it is called Mexican or Ring-tailed Cat. Dr. Newberry gives the following account of this unique animal in the *U. S. Pacific R. R. Report on Mammals:* "This beautiful animal, which was formerly supposed to be peculiar to Texas and Mexico, has since been found somewhat abundantly in California. The district in which it occurs, if not exclusively, certainly most abundantly, is that including the foot hills of the Sierra Nevada, on the eastern side of the great trough of San Joaquin and Sacramento. In this half-wooded region, the home of the gold hunter, it is well known. The miner calls it the Mountain Cat. It frequently enters his tent and plunders his provision bag. When caught, as it often is, it becomes so familiar and amusing, and does so much to relieve the monotony of the miner's life, that it is highly valued, and commands quite a large price. The Bassaris is, perhaps, equally

Fig. xii.

American Civet.

efficient as a mouser with the common Cat, is much more playful, and, to a large number of the members of every community who are Cat-haters, might be a desirable substitute." Mr. Charlesworth sent some specimens of the Bassaris to the British Museum, and remarks that it is sometimes called Basset, and that the Mexican term is pronounced Cacomistle. He says it is abundant in the city of Mexico, and that it frequents the barns and out-houses, like the Cat, seeming never to be met with far from the abodes of man. Its habits are nocturnal. Its ravages among the hen-roosts and pigeons earn for it an undesirable reputation, differing in this respect from the same among the miners of California, where it proves a pleasing pet. It has two or three at birth. Mr. Waterhouse observes that the skull has all the characters of the Paradoxuri.

EXTINCT FORMS ALLIED TO DOGS AND CATS.

Canidæ.—Fossil remains of Canine animals have been known more than one hundred years. In 1772 they were found in the caves of Franconia, in Europe. Schmerling found bones of the domestic Dog in the caverns of Liége. The common Wolf of the present day seems to have existed in these caverns at the same period; and the two were probably co-existent with pre-historic Man. Remains of the Dog were found by Lund in the caverns of Brazil, and they are regarded as bearing a close relation to those of the species now existing in the same region.

Canis.—Fossil extinct species of this genus have been taken from Upper Miocene deposits of the Si-

walik Hills of India, as well as from the Post Pliocene and Pliocene of Europe. The Upper Eocene of France has furnished some forms. Four species were found in the Post Pliocene deposits of North America, and in the Miocene of Colorado are four species. Prof. Hayden obtained the jaws of an extinct species of Wolf, which he names Canis sævus. A smaller species, represented by fragments of jaws found with the former, he calls C. temerarius. Another, larger than any of the American Wolves, from the same locality, is named C. haydeni. Canis vaver is a species of Fox, about the size of the present Swift Fox (*C. velox*), founded on jaw fragments from Nebraska. Another, quite as large as the Wolf, is described by Prof. Marsh as C. montanus. C. incertus is found on the banks of the Parana River. C. protoplax and C. robustior are from Brazil. Canis indianensis is a form first described by Dr. Leidy as C. primævus, but is now regarded as quite distinct from that species. It is founded on an upper maxillary, with teeth, from the banks of the Ohio River, near Evansville. It is also represented by the ramus of a lower jaw, found in California. Its time is in the Quarternary Period, and indicates an animal larger than any living Wolves of either continent. It is less robust than C. primævus and C. haydeni, but larger than C. sævus of the same formation.

Sinopa.—This genus is founded on a few bones found in the deposits at Fort Bridger, Western United States. It was about the size of the Gray Fox, and is judged to be intermediate between the Weasels and the *Canidæ*. One species is known, and named S. rapax. It is regarded as one of the most ancient forms of this Order thus far discovered.

Vulpavus is another form found at Fort Bridger, and described by Prof. Marsh as V. palustris.

Mesonix is an extinct genus, described by Prof. Cope in Hayden's *Report of the U. S. Geological Survey of the Territories*, with one species, M. obtusidens. He regards it as representing a family distinct from any now living on the globe, yet more closely allied to the *Canidæ* than to any other. The remains were found on the bluffs of the Cottonwood River, and measured the size of our largest Wolves.

Amphicyon is a name given by Dr. Leidy to an extinct genus of Carnivores, established on fossil remains found in the Middle Tertiary deposits of France and Germany. The general form and construction of skull, and character of the teeth, indicate a near relationship to the Wolves. A dozen species have been indicated as once extant in Europe; one viewed by Cuvier was pronounced a "Dog of gigantic proportions." Remains of two species, referable to the same genus, have been discovered in the Miocene Tertiary deposits of the Mauvaises Terres of White River, Dakota. A. vetus is about the size of the living Prairie Wolf, and was indicated by the discovery of a mutilated cranium and fragments of a jaw and teeth by Dr. John Evans and Prof. Hayden. A smaller species, less than any existing Fox, indicated by fragments of jaws, teeth, and the facial portion of a skull of several individuals, was discovered by Hayden, and named A. gracilis.

Galecynus is a term given to an extinct genus, representing a Fox-like animal, intermediate between the Dog and the Viverras. This is from the Pliocene of Œninghen, in Switzerland.

Thalassictis and Ictitherium.—These terms are applied by authors to extinct genera of *Viverridæ*, which resemble the Hyænas. They are represented by three species, larger than the existing Viverras.

Simocyon is an extraordinary Carnivore, of the size of the Panther, having canines of a Cat, the molars of a Dog, and jaws shaped like those of the Bear.

Protocyon is an extinct genus, with two species—P. troglodytes and P. validus—from the bone caves of Brazil.

Speothus is from the preceding locality, and has one species—S. pacivorus.

Abathmodon is recorded as an extinct genus from the same region.

Cynodon.—Three species of this genus have been discovered in France.

Palæonictis is represented by one species—P. gigantea—in European deposits.

Soricictis is another, from the same region, having one species—S. leptorhincha.

Elocyon, with one species—E. martrides—also belongs to the European fossiliferous regions.

Otocyon is a living genus, resembling the Dogs, found in South Africa, a region not much known to palæontologists. It has one species—O. megalotis. The generic name is from the Greek, and refers to dog's ear, the specific name indicating big ear.

Vulpes is represented by two species from the Gypsum beds in the Eocene of Paris, France.

Hyænodontidæ is the term given to an extraordinary family, extinct and fossil, exhibiting a relationship with the Canine Family on one hand, and the Feline on the other, with certain ties to others. The term refers to the fancied resemblance of the teeth to those of the Hyæna. By some, this family has been referred to the Marsupials, based upon the fossil remains of several species that were discovered in the Lower and Middle Tertiary deposits of France, particularly in the Paris Basin. Prof. Gervais obtained a cast of the interior of a cranium of one of the species, and asserts his belief that it is allied to the marsupial Thalacinids, particularly through the sectorial character of the true molars; on the other hand, it resembles the Carnivores in the development of only six incisor teeth in each jaw, and the absence of the inflected margin of the lower jaw.

Hyænodon.—This is the type of the family, partaking of the characters, in part, of the Hyænas, Cats and Wolves. Dr. Leidy has described three species from the Miocene of Dakota. The largest is H. horridus, equal in size to a Black Bear. H. cruentus and H. crucians are smaller species, about the size of a Cat or Red Fox. Some authors assert that the Hyænodon shows, in addition to the above characters, a resemblance to the Weasels, the Raccoons and the Opossums; to the latter, probably, through the character of brain indicated by the features dis-

cerned in the cast made by Gervais. The genus was first brought to light through discoveries of remains in France. Dr. Evans and others have since found six species in the Mauvaises Terres of Dakota. H. horridus is regarded as exhibiting characters that indicate one of the most sanguinary beasts that has ever existed, to our knowledge. It is indicated by the greater part of two skulls, together with a few fragments of jaws and teeth of other individuals. The specimens of jaws and teeth have afforded us a view of the entire dentition of the animal, which is truly formidable. The powerful canine teeth are supplemented by the unusual number of three teeth, constructed nearly after the model of the single sectorial tooth of other carnivorous mammals, though the last one alone reaches full development of the corresponding tooth in the latter. The true sectorial molars of the Hyænodon, the last of the series of teeth, are constructed like those of the Lion and Tiger. These teeth are the broadest and strongest of all, and combine the mechanism of the wedge and scissors, thereby being exeeedingly appropriate for cutting animal tissues, even including the solid bones. The temporal fossæ are enormous, and enclose masses of solid muscles, which operate with exceeding force on the long levers of the lower jaws. The skull of this speeies measures about a foot in length. H. crucians is much smaller. A half dozen imperfect skulls, with fragments of jaws and teeth and other bones, have been found, from which the species was established. Though small, comparatively, it exhibits the same possibilities in the dentition and strength of jaw that the larger has. H. cruentus was found in fragments at the same locality as the preceding.

Mesonix is referred to the same family by Prof. Cope, who has indicated it by remains found in the Eocene of New Mexico and Wyoming, associated with several others, which could not be seen to belong to any existing family.

Synoplotherium.—A fore-foot and leg of a form hitherto not known were found in the deposits of Mammoth Buttes, near South Bitter Creek, Wyoming, and named by Prof. Cope as above. One species only has been recognized, which is called S. lanius. It presents a more generalized type than others before mentioned, resembling the Hyænas and the Bears. This is figured in Hayden's *Report of the U. S. Geological Survey of the Territories*, 1872. Prof. Marsh has described two genera from the same formation, which embrace species approaching this.

Stypolophus is a genus formed by Prof. Cope from remains obtained by him in the Eocene of the Bridger group, associated with the preceding forms. This embraces small Carnivores closely allied to the foregoing. S. insectivorus, S. pungens and S. brevicalcaratus are indicated as species.

Viverravus is another form allied to the latter, and named by Prof. Marsh. The species, V. parvivorus, was determined by Prof. Cope from fragments of jaw and other bones found at Black's Fork, on Green River.

Icticyon.—Wallace remarks: "*Canidæ* are represented in South America by Canis and Icticyon."

Hyænictis is a genus occurring in the Upper Miocene deposits of Greece and in Hungary.

Lycæna and *Hemicyon* are genera partaking equally of the characters of the Dog and Glutton; found in same locality as preceding.

Pseudocyon is allied to the Wolf and Fox families, and, with the two preceding forms, are from the Upper Miocene of Central and Western Europe.

Pterodon is an allied form from the beds of the Upper Eocene in France.

Ælurogale is another of the same period, from the Phosphate beds of the south of France.

Galethylax, *Cyotherium* and *Cynodictis* were small, and, with the existing genus Canis, are found in the Upper Eocene of France.

Arctocyon represents an animal about the size of a Wolf, and is regarded as a very ancient and generalized form of Carnivore, which cannot be placed in any existing family. It is found in the Lower Eocene of France, and is thus the oldest known member of the *Carnivora*.

Patriofelis, *Uintacyon* and one already recorded above—the Sinopa—are animals nearly the most ancient of the order. They are recognized by some remains found in the Middle Eocene of Wyoming, by Prof. Cope, in 1875. They are all of large size, and belong to no existing family. P. ulta was determined from portions of the lower jaw by Dr. Leidy.

Pachyæna is from the preceding locality, and is allied to Pterodon.

Prototomus, from the same locality, is allied to Amphicyon and the *Viverridæ*.

Limnocyon is a Civet-like Carnivore, with resemblances to the Canine animals, and is from the same region as the latter.

Machærodus.—This is a form exhibiting enormously developed Canine teeth. It was larger than the existing Lion and Tiger. Remains of this creature were found in the Miocene of Greece. It is an interesting fact that the great Carnivores whose remains are now found in Middle Europe are now entirely confined to tropical regions. The present form exhibits characters that suggest the extreme development of the Feline race. It is found in the Siwalik Hills of India, in the Upper Miocene of Dakota, in the Brazilian bone caves, and in the Pliocene Period of temperate South America. This great flesh-eater, or sabre-toothed Tiger, as its name suggests, was recognized in the deposits of Dakota from perfect crania, on which is distinctly seen the lengthening downwards of the chin to receive and protect the enormous canine teeth. The upper canines are nearly as long as the entire lower jaw. It has been suggested that this is a fair example of the mutual correlation of structure—for offence and defence—of animals inhabiting the same region; the powerful jaws and enormous upper canines being, apparently, purposely adapted for tearing up the large Armadillo (*Glyptodon*), whose carapace or upper shell is found in the superficial deposits of South America, of the same age, and is seemingly an impenetrable tortoise-like armor. The Jaguar is the living representative of this monster. Dr. Lund dis-

covered the remains of the Machærodus in the Brazilian caves, and expresses the opinion that they are of the same age as those of Europe, viz.: the Pliocene, subsequent to the Glacial Epoch. The band of territory extending, with interruptions, along the line of the Missouri and the Mississippi Rivers, from the northern shore of the Gulf of Mexico to the Arctic Ocean, is prolific in the remains of extinct animals. That portion along the Missouri River—the Mauvaises Terres—has furnished enormous quantities of bones, a large portion of which are of extinct forms. The range of these Feline beasts of a by-gone age must have been considerable on each side of this long Tertiary belt, extending, probably, towards the Atlantic seaboard.

"The teeth of Machærodus are long, curved and compressed, with usually a trenchant and serrated edge behind and before; whence the name, 'sabre-toothed Tigers,' applied to the group, which has been divided into three genera, viz.: Drepanodon (from the Greek, a scimitar); Smilodon (from the Greek, a chisel or graver); and Machærodus. Many species have been described from the Middle and Later Tertiary and the Quarternary deposits of Europe, Asia, North and South America. The dental formula is the same as in the Cats, viz.: Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{1-1}{1-1} = 30$ teeth. The sectorial or flesh tooth is the last premolar in the upper jaw and the true molar of the lower jaw. The true molar of the upper jaw is a tubercular tooth. The lower canines are small. The incisor teeth are larger and longer than in the Cats."—*Marsh.*

A species from the Mauvaises Terres of Dakota is named M. primævus, which is somewhat smaller than the living Cougar or Puma. The skull resembles that of the latter quite closely; the orbit, however, is smaller, and the brain-case is less in capacity. The fore part of the lower jaw, below the symphysis, is prolonged downward for the protection of the large upper canines when the mouth is closed. A larger species is recognized, from more imperfect remains, from the same locality of the Miocene Tertiary. In the Siwalik Hills of India another Miocene species is found, and is called M. sivalensis. Another, from the Tertiary of Val d'Arno, is a large species, the upper canines measuring eight and a half inches along the anterior curve. From the Quarternary of Kent's Hole, in England, a species, called M. latidens, was exhumed, and this is thought to have equalled the largest Tiger of the present species in size. A still larger and more powerful one, named M. neogæus, was discovered in the Quarternary deposits of the Brazilian caves. In this species, the canines projected about eight inches from their sockets. The later species of Machærodus were, without doubt, coeval with Man; but the group became extinct before the commencement of the Historic Period.

Felis.—This existing family is represented in the bone caves of Europe by an extinct species—the F. spelæa. Nearly every cave in Europe has remains of this extinct animal. It is known as the Cave Lion, its specific name indicating its usual locality. Its remains are exceedingly abundant, associated with those of the larger quadrupeds. In size it differs but little from the existing species, and in other respects nearly corresponds to them. The bone caves of England are stored with the remains of great numbers of this and other mammals, whose living representatives are now known to require a much warmer temperature. It is inferred, therefore, that the climate has changed very materially. Felis aphanista is a much larger species, found originally in the Miocene sands of Epplesheim. The beds of Sansans, in France, have furnished a smaller species. Several teeth, in fragments of upper jaws and portions of the lower jaw, indicate a species of Tiger apparently different from any previously described. The specimens were discovered by Prof. Hayden, during Lieut. Warren's Expedition in 1857, on the Loup Fork of the Niobrara River, Nebraska. They belong to the Pliocene Tertiary formation, and the species is called F. angustus. Felis imperialis is a species determined from fragments of jaw found in San Leandro, California. The specimen indicates a species equal in size to the largest living Bengal Tiger. Felis exilis is a species found by Dr. Lund in the Brazilian caverns, and another from the same locality is called Felis protopanther. Felis atrox is from the Miocene of the Mauvaises Terres, Missouri. In the Upper Miocene of Pikermi, near Athens, in Greece, M. Gaudray collected a large number of genera and species of extinct mammals, among which were four species of Felis, ranging from the size of a Cat to that of the Jaguar. The widely-distributed Machærodus was associated with them. The Siwalik hills of India furnish several extinct Feline forms, and the same is true of other Asiatic regions. The Post Pliocene of America has two species as large as the living Lion.

Trucifelis is a form of *Felidæ* as large as the present Lion, lately discovered in Texas.

Oxyæna, consisting of several species, some as large as the Jaguar, was allied to Hyænodon and Pterodon. These were discovered in the Tertiary of New Mexico.

Pachyæna is another form allied to the preceding, and found in the same deposits.

Cynælurus, the genus containing the Hunting Leopard of India, is represented in the Brazilian caves by an extinct species smaller than the living one. It is associated with five species of Felis and the widespread Machærodus.

FAMILY—HYÆNIDÆ.

This family is not represented in America by present living forms nor by extinct fossil remains, as far as is known. The genus Hyænodon, found in the Niobrara districts of the Western United States, as well as in Europe, is of another family, bearing a name which only signifies Hyæna-like tooth. The Hyænas are strictly African. Wallace accords them one genus and three species. Other authors introduce the term Protelis as the generic name of the Aard Wolf, and thus make two genera. The typical name Hyæna signifies, in Greek, a Sow. Fossil remains of Hyænas have been found in Europe and in

the Himalayas. The Cave Hyæna is a notable one, and abundant in the caves of England. In the Miocene of Europe occur quite distinct genera, which have been named Hyænictis and Lycæna—the latter from the Upper Miocene of Greece. Ictitherium is another, supposed to be intermediate between the *Viverridæ* and *Hyænidæ*, and Thalassictis, which unites the Weasels and Hyænas.

FAMILY—CANIDÆ.

Members of this family are pretty evenly distributed over this continent and Asia. Europe and Africa have few. The proportion of species to the several continents is given by one author as follows: Europe and Asia, fifteen; North America, ten; South America, nine; and Africa, eight. A number of these species are found in more than one country; Europe has five, four of which are in Asia, Africa and America. In Australia the sole representative known is the Dingo, which, being the only non-marsupial of any considerable size in the country, it is thought that it may have been introduced. Wallace enumerates three genera, seventeen sub-genera, and fifty-four species. In many respects the Dogs resemble the Hyænas more closely than the Cats; they have, for instance, non-retractile claws.

The characters of *Canidæ* are given by Prof. Owen as follows: "The incisors are in a series, forming the segment of a circle, and increase progressively in size from the first to the third or outer one; the trenchant margin of the crown is divided by two notches into a large middle and two lateral lobes, the inner lobe being obsolete in the external incisor. The premolars have strong, sub-compressed conical crowns, gradually enlarging posteriorly, and acquiring one or two accessory posterior lobes with the increase in size. The fourth upper premolar is the sectorial tooth, and is much larger than the one anterior to it; its blade is divided into two cones by a wide notch, the anterior cone being the strongest and most produced. The tubercle is developed from the inner side of the base of this lobe. The first and second upper molars are tuberculate; each supports two external cusps and a broad internal basal, subtuberculate talon. The second molar is less than half the size of the first. The first true molar below is the sectorial one; the blade is divided by a vertical linear fissure into two cones, the posterior the largest; behind this the base of the crown extends into a broad, quadrate, tuberculate talon. The second molar has two anterior cusps on the same transverse line, and a posterior broad, flat talon; the last lower molar is the smallest of all the teeth. The incisors, canines and first premolars have each a single fang; the second and third premolars above, and all premolars and molars below, have two fangs, except the last lower molar, which has but one. The upper sectorial or fourth premolar, and the last upper true molar, have three fangs. The first upper true molar has four fangs." The deciduous dentition of *Canidæ* is: Incisors, $\frac{3}{3}-\frac{3}{3}$; Canines, $\frac{1}{1}-\frac{1}{1}$; Molars, $\frac{3}{3}-\frac{3}{3}$; $=28$.

The more conspicuous characters, as distinguished from the Cats, are seen in the elongated muzzle, pointed and erect ears, smaller eyes, longer hair and bushy tail. There is a difference observable in the eyes of some of this group, the Wolves having the pupils round, while the Foxes have them elliptical. Burmeister has pointed out an important distinction in the form of the post-orbital process of the frontal bone. In Wolves it is triangular, and convex on its upper surface, rounding outwards and downwards, with the point extending below the plane of the inter-orbital space. In the Foxes this is hardly convex above; in some instances it is concave, and the point scarcely dips at all. It is a notable fact that all South American forms of the Fox-like animals have the Wolf type of structure; their pupils being nearly circular.

SUB-FAMILY—LUPINÆ.

The Canine animals have been grouped into two quite natural sub-families, the Lupines or Wolves, which, according to later authors, include all the South American forms, being called *Lupinæ*, and all the true Foxes are the *Vulpinæ*. This sub-family is characterized as having a very convex post-orbital process to the frontal bone, which curves downwards, with little or no indentation or depression in its upper surface.

CANIS.—*Linn.*

The generic characters of Canis are essentially that of the sub-family. Burmeister has separated the Fox-like Wolves of South America, calling the groups, respectively, Lycalopex and Pseudolopex. If this arrangement be adopted, there should be some modification in the statement of generic characters. The pupils in this case are entirely circular and large, the tail rather short, in distinction from the smaller size—long tail, slender muzzle, and pupil varying from round to elliptical. The arrangement of Prof. Baird, in recording the North American species, has been followed, and reference made to Dr. Gray's paper (*Proc. Zoöl. Society*, London, 1868,) in treating of the South American forms.

NORTH AMERICAN CANIDÆ.

GRAY WOLF (*Canis occidentalis, De Kay; Lupus occidentalis, Gray*).—According to Richardson, who is considered the best authority on this subject, a striking difference is seen in the general aspect of the European and American Wolves, which were considered at one time merely varieties of one species. He says: "The American Wolf of the northern districts is covered with long and comparatively fine fur. Its form is more robust than the European; its muzzle is thicker and more obtuse; its head larger and rounder; and there is a sensible depression at the union of the nose and forehead. Its forehead is more arched. The ears are shorter and wider; and several other points are noticeable wherein a difference exists. In the European Wolf the fur is coarser, with less of the soft wool which is found under the long, soft hair of the other. Its ears stand higher, and appear to be nearer together. Its loins are more

slender, its legs longer, feet narrower, and its tail more thinly clothed with fur." The specimens observed by Richardson were mostly from the coldest regions, and were, therefore, more likely to be clothed with the soft and fine fur than the European ones of a lower latitude that he had probably seen. Great difficulty has been experienced in determining the correct relation of the several varieties which have been observed in North America. Prof. Baird says: "It is difficult to occupy a middle ground between considering all our Wolves as one species with many varieties, or making all these varieties into as many distinct species. Thus we have the pure white Wolf of the Upper Missouri; the dusky blackish-plumbeous Wolf of the Missouri; the entirely black Wolf of Florida and the Southern States; and the entirely red or rufous Wolf of Texas. These vary, too, in shape, as well as in color, the more southern ones appearing usually more slender, and standing higher on the legs—in consequence, perhaps, of the comparative shortness and compactness of the fur. The more usual variety of color, perhaps, is the gray, which is found all over North America to the Arctic regions, the others being more local in their distribution. * * * In conclusion, I am not able to come to a decision as to the absolute number of species of North American Wolves. Of existence of varieties of color and, perhaps, of form and internal structure, there is no doubt. For the present, I prefer to consider all as one species, and to assume this with good reason, as distinct from some at least of the European Wolves, if that continent possesses more than one." Maximilian, in *Journey to North America*, 1841, says: "This Wolf (*Canis variabilis*) is distinguished from that of the Eastern States (which resembles the European) by the somewhat smaller size, shorter, thicker snout, somewhat shorter ears, and by the want of the dark stripe running down the legs in C. lupus of Europe; also by the color, varying from the ordinary Wolf's gray to pure white. In any troop of these, one may see some that are entirely white and pale, some more mixed with gray, and others that are entirely gray. In the living animal the iris is whitish-gray, washed with yellowish, dotted with dark on the external border, and colored with yellowish-brown around the pupil; in a word, the iris is pale yellowish-gray-brown, darker around the pupils. The gray variety has around the eye, the cheeks and sides of the mouth, whitish; forehead mixed with gray; top of nose pale reddish; the short, truncated ears are pale grayish-yellow; upper parts of the animal are yellowish-gray, with decided black tips to the hairs; legs, belly and lower parts of the body, unmixed whitish. The dark longitudinal stripe on the fore-legs of C. lupus is not found in this species. A specimen of this Wolf, killed at Fort Clark, and reduced by hunger, weighed 58 pounds, and the penis bone was 4″ 7‴ long. The varying Wolf brings forth from four to nine young, in April, in its burrow."

THE DUSKY WOLF (*Canis occidentalis, var. nubilus, Say*).—The general aspect of this variety is a dusky leaden color, with cloudings of black and shadings of grayish on the sides of neck and shoulders and back. A variety called Mexicanus—the MEXICAN LOBO WOLF—is varied with gray and black, has more of a mane than usual, a black or dusky band around the muzzle, and a dusky stripe down the fore-leg. Audubon calls this Lupus gigas, and gives several anecdotes concerning its immense strength and endurance.

THE BLACK WOLF (*var. ater*) is entirely a jet black. This variety is found more numerous in Florida than elsewhere. Audubon says it was very abundant in Henderson, Kentucky, when he first resided there. He killed one in the act of seizing a turkey in his yard; the brute squatted, and evidently aimed to avoid being seen. He describes a practice then current among planters of constructing falls—pits dug in the earth, and covered lightly with foliage, and baited. At one time he accompanied a neighbor, and found three in one pit, two of them the black variety. Audubon was quite astonished to see the planter jump into the pit with the three beasts, and deliberately cut their hamstrings. The animals were then hauled out and given to the dogs to fight, as it is supposed they were too much for the curs, whole-handed. He wished to "sharpen the dogs' scent, too." On another occasion he observed a beautiful black Wolf following a man like a Dog. It proved so entirely tame that the owner had become attached to it, and refused to part with it for a large sum. The variety called White Wolf in the West is exceedingly abundant in the Missouri River region, and is often in company with the Prairie Wolf in large bands. Mr. Bell has told us that when he went through that country with Mr. Audubon, they saw eighteen in one gang. They cross with the Dogs of the Assiniboni Indians. The gait of the American Wolf is much like that of a large Newfoundland Dog.

THE RUFOUS WOLF (*var. rufus*) is a very common variety in Texas, though all others are found there. Its color above is a mixed red and black; beneath it is lighter.

PRAIRIE WOLF (*Canis latrans, Say*).—Plate I. fig. ii.—This is a well-known animal in the western portion of North America, where it is also called COYOTE. Eschscholtz, in 1829, described this animal, which he found in California, and named C. ochropus; it was also noticed by the zoölogists of the corvette Sulphur. Woodhouse has described it as C. frustror; and in Lewis and Clark's Expedition it is recognized as the Burrowing Dog (*Lyciscus cajottis*) of Hamilton Smith. This animal resembles the Fox in the sharpness of its muzzle, and the Wolf in the fulness of its tail. It is, however, a true Wolf, and suggests a representation here of the Old World Jackals. Considerable differences have been noticed in the development of specimens from various parts of the continent, but an examination of large numbers has resulted in clearing away any doubts that were entertained, and now only one species is recognized. Maximilian regards the Prairie Wolf as exactly intermediate in size and shape between the Wolf and Fox; in dentition, agreeing more closely with the Wolf, inasmuch as the front teeth are

lapped on either side. The shape is Wolf-like, the neck short and thick, the body thick; the head, however, is smaller and somewhat more like that of the Fox; the tail is short and thick, as in the Wolf; the legs tolerably high; the snout is longer and more pointed than in the Wolf; the ear is tolerably pointed, strong, fine, and shaped as in the latter; the head is broad above; the end of the nose black and moist; the internal ear well supplied with hairs; the whiskers long and black, and other similar hairs implanted along the corner of the mouth and above the eyes. The entire animal is of a dirty grayish-yellow, with the ears and top of the nose inclining to reddish. It brings forth its young in burrows in April, often as many as ten in number. Its bark is much like that of the domestic Dog. Hunters agree in noticing that the Prairie Wolf is exceedingly inquisitive, a probable cause of which is its enormous appetite; for no sooner is the report of a gun heard than all the curs within earshot are on their feet, and venture to approach even toward the hunter. They learn to connect the sound of fire-arms with what often results, and forthwith anticipate a feast from the fallen carcass. This species is about thirty-eight inches in length, from the nose to the base of the tail; the tail to end of the vertebræ is fifteen inches; including the terminating hairs, it is about three inches more. The ears are three and a half inches in height. This Wolf, in Gray's later arrangement (1868), is called Chrysocyon latrans, and follows the C. jubata.

SUB-FAMILY—VULPINÆ.

This group is characterized by an elliptical pupil and a slender head. The upper incisors are scarcely lobed. The post-orbital process of the frontal bone is but slightly bent downward, and the anterior edge is turned upwards; a longitudinal shallow pit or indentation is seen at the base. This includes the Foxes of North America, several distinct types of which are indicated. In one, the tail is composed of long hairs mixed with the shorter fur in even proportion, and exhibiting a handsome bushy cylindrical appendage. The skull is more or less Wolf-like in shape, and several minor details are noticed in the cranium. To this group the generic term Vulpes is applied. The Gray Fox represents the other group. Certain anatomical differences are remarked in the skull, and the muzzle is much shorter; but the most striking feature is seen in the concealed erect mane of stiff hairs along the upper line of the tail, unmixed with the fur at all, on each side of which the rest of the hair is arranged, the latter falling down on the sides in a manner quite different from that in the Red Fox. The members of this group are designated as Mane-tailed Foxes, Urocyon being the generic term, meaning literally Dog-tailed.

AMERICAN FOX (*Vulpes fulvus, Rich.*)—Several varieties are noticed, which are regarded as only such, all really being the same species, but having unimportant differences in color and size. The red variety is a bright, clear, yellowish rufous, darkest on the fore part of the back and shoulders, where the color has a rich purplish tinge. A variety of the red is sometimes called the Sampson Fox, which has the tail and body without the thong hairs, the soft woolly fur being entirely exposed. The red tints are lighter, and there are no grizzled hairs on the hinder back. The tail has no black in it. In Northern Ohio, this variety is most known. Prof. Baird remarks that he has seen a similar condition of the hair among skins of the Canis griseus of Chili, and in some other species. The common Red Fox of America was long regarded as identical with the European Red Fox (*V. vulgaris*). Differences exist, though so slight that a comparison of numerous specimens of adults is required to establish the matter quite fully. In the American Fox, the texture of the fur differs in being much longer, more silky and softer. The tail is more bushy and more nearly cylindrical. The muzzle is shorter, and the eyes are placed nearer together. The feet are larger. The red color is not so dark; the tint is less uniform over the body; and the beautiful golden hue which distinguishes the fur of the American animal is wanting in the European. In Gray's paper, in *Proc. Zoö. Soc.*, London, 1868, this species is called Vulpes pennsylvanica.

CROSS FOX (*Vulpes fulvus, var. decussatus*).—This is regarded as a variety only, but has been distinguished by the above specific title by Geoffroy and others. It is called Cross Fox from the fact that a dark band extends along the back, which is crossed by another of same color on the shoulder. It is seldom found south of Pennsylvania, but is common in New York. It is larger than the Red Fox, and has a more bushy tail. The under surfaces of the feet are more closely furred. The muzzle, legs and under parts generally, including the inside of the limbs, with the convexity of the ears, are black. The tip of the tail is entirely white.

SILVER FOX, BLACK FOX (*Vulpes fulvus, var. argentatus*).—"The color of this variety is a uniform lustrous black, with a distinct white tip to the tail. On the top and sides of the head, however, and on the posterior half of the back, including the outside of the thighs, the long hairs are grayish-silvery at the end (the extreme tips black), grizzling the back very conspicuously. The same feature is observable at the base of the tail and to some distance on its sides; it is also seen slightly on the shoulders. The under fur is of a sooty color, not very dark, however, and becoming lighter on the sides of the neck and flanks. In the only one of the three specimens in the Smithsonian Collection at Washington, No. 1190, in which the feet are entire, the soles are much less densely furred than in the Cross Foxes, and more nearly resembling the Red Fox of the Eastern States in this respect. It is by no means certain that these specimens are not black varieties of the Vulpes macrourus."—*Baird.* Remains of the Red Fox are conspicuously absent in the bone caves of America, while those of the Gray Fox are abundant; this fact is worthy of weighty consideration when we reflect that it is possible that the European Fox may

have been imported from the Old World, as we know that the Horse certainly was introduced here by the Spaniards.

PRAIRIE FOX (*Vulpes macrourus, Baird; V. utah, Aud. and Bach.*)—This is the Fox *par excellence* of America, and is regarded as the finest species known. Its specific characters are seen in its size, and length of fur and tail, exceeding the V. fulvus. The tail vertebræ measure eighteen inches, the width of tail about eight to nine inches. The ears are very large, and acutely pointed, exceeding in these particulars the Red Fox. The eyes are even nearer together than those of the latter, which feature is strikingly different from that of the European animal. The colors are much like those of the fulvus. A dark yellowish cross is descernable on the shoulders, and the upper part of the head is grizzled like the lower part of the back. There is more white, especially on the lower parts, than in the latter. The fore-feet are black; on the hind-feet, this color only extends in a narrow line on the anterior face. The length of the Prairie Fox is thirty-three inches from the nose to the tip of the tail. A notable peculiarity of the skull of this Fox is the elongated and slender muzzle, which exceeds that of the Red Fox as much as that of the latter does the same part in the European animal.

THE KIT FOX, SWIFT FOX (*Vulpes velox, Aud. and Bach.*)—This is the Canis cinereo-argentatus of Richardson and Sabine; C. microtus of Reichenbach; and the Kit Fox and Burrowing Fox of Lewis and Clark. It is smaller than the Red Fox. The head is short and broad; the ears are small; the legs are short. The tail is very dense, cylindrical and bushy, and is about half as long as the body and head. The general color above, including the ears and tail, is yellowish-gray. The back is prominently grizzled. The sides and portions of the legs are pale reddish-yellow; other parts of legs, whitish. The tail is tipped with black. The under fur of this species is exceedingly dense, showing plainly through the longer hairs. The soles are densely covered with hair, quite concealing the naked pads. The fore-claws are sharper and more curved than in others. The ears are much smaller, are thicker, and are densely coated with hair on both sides, except in the passages. This Fox is considered too distinctively marked to be confounded with any of the American species; the Canis corsac of Siberia is nearer it than any other, according to Richardson. Maximilian says: "This species, C. velox, scarcely half the size of the European Red Fox, is shaped somewhat like it. * * * The eye is greenish-gray, with darker pupil. * * In winter, the animal is more of a pale grayish-brown, washed with brighter; all the hairs with decided white tips. The total length is two feet, eight inches, seven lines. The stomach is considerably curved; it was commonly full of fragments of skin, leather, with hair, berries, remnants of mice and grasshoppers, upon which the Foxes of the prairies are necessitated to live on in a great measure. The female brings forth from four to eight young, in holes, in March or April."

ARCTIC FOX (*Vulpes lagopus, Linn.*)—This beautiful creature is, as its name imports, a denizen of the Arctic regions of the globe, and is seldom seen farther south. Audubon claims that it is occasionally found in Newfoundland. It is smaller than the Red Fox; its tail is large and full; soles of the feet thickly furred, which gives rise to the specific name. The adult is pure white, the young a greyish-lead color. The term Pied Fox is sometimes used for this species, as in *James' Voyages*, 1633. Pennant called it Greenland Dog; Godman has it Isatis or Stone Fox; the Esquimos of Melville Island call it Terreeanee-arioo; the Greenlanders, Terienniak; the Russians, Peszi. The Arctic Fox becomes very tame when kept near a camp, and the wild ones suffer themselves to be caught very easily. See also vol. i, p. 105.

GRAY FOX (*Vulpes virginianus*).—This is one of the forms claimed as Urocyon, the Gray Fox being typical of the group of that name alluded to under the sub family heading. Dr. Gray calls them bristle-tailed Foxes. It is the Canis cinereo-argentatus of many writers; C. griseus of Boddaert; Renard tricolor of St. Hilaire and Cuvier. The specific characters of this species are seen in the head and body being somewhat over two feet in length, the tail rather more than half as long, with a concealed mane of stiff hairs. The prevailing color is a mixed hoary and black. The convexity and base of the ears, sides of neck, edge of the belly, and a large portion of the fore-legs, are a rusty or cinnamon color. Encircling the muzzle is a black band, widening on the chin. The lower portion of face, and the throat, are pure white. The tail is hoary on its sides; on the upper side and its tip, black; beneath, rusty. The Gray Fox is found in the Middle States, in Texas and California, and on the north-west coast at Fort Vancouver.

COAST FOX, SHORT-TAILED FOX (*Vulpes littoralis, Baird*).—This is another of the group for which the generic term Urocyon has been suggested. It is hardly more than half the size of the preceding species. The tail is about one third the length of the body. The body above is hoary and black. The sides of the neck, fore-legs and lower parts of sides, a dull cinnamon. The chin and sides of muzzle, black. The tail has a concealed mane of stiff hairs, as in the Gray Fox, and with a black stripe on the upper surface. This is the smallest of the American species. Lieut. Trowbridge, U. S. A., brought a number from San Miguel, California, where, he says, they are very tame, scarcely taking the trouble to get out of the way, and, when escaped from a trap, returning directly to the same place—in this, resembling the Arctic Fox, which is said to even enter the trap a second time almost immediately. This species is a miniature of the Gray Fox, so closely resembling it that a casual observer might well mistake it for a smaller individual of the same. In the history of several specimens recorded is mentioned the circumstance of the tail vertebræ being missing, the result seemingly of mutilation. This curiously compares with similar facts concerning the Psora of California. Among the few points of difference between this and the preceding is a softer and fuller fur, the coarse

hair not much exceeding the under fur. The tail is shorter, but the mutilation above mentioned must account for this feature. The head and body of an adult measured eighteen inches only, while the Gray Fox is twenty-four to twenty-eight inches in length.

South American Canidæ.

In a paper on the *Canidæ*, by Dr. J. E. Gray, in *Proc. Zoö. Soc.*, London, 1868, the South American forms are very fully considered, more with reference, however, to the crania of the different species. The North American forms we have described according to the arrangement most familiar to American naturalists—that of Prof. Baird, in *Mammals of North America*. The Canines of the southern continent we place in accordance with Dr. Gray's system. He remarks in his paper: "The Dogs form a very natural group; and it was early divided by the community and naturalists into Dogs and Foxes, according to the length of tail and sharpness of face. The *Canidæ* have been separated by general consent into three natural groups, according to the length and form of the tail—the Wolves having a short and straight tail; the Dogs a more or less elongated tail, bent to the left, and more or less curled; the Foxes an elongated bushy tail. In South America there is a group with skulls like Wolves, but with long, slender tails, which may be called long-tailed Wolves. There is no doubt that the form of the tail affords very permanent characters, and has considerable influence on the habit of the animal. Dr. Burmeister has divided the family into two tribes, according to the form of the post-orbital process: First, *Lupinæ*, including the genera Canis, with a short tail, and Lycalopex and Pseudolopex, with elongated tails, the skull being generally thick and solid; Second, *Vulpinæ*, including Vulpes and Urocyon, the skull being elongated, slender, thin and light. The habit of the animal is generally nocturnal, and the pupil of the eye elliptical, erect." In this arrangement, under the genus Lupus, the species occidentalis of North America is described.

Chrysocyon.—*Burm.*

Members of this genus have the head very long and nose slender. The pupils are round. The tail is short, reaching only to the hocks. The skull is elongated; nose very long; coronal crest is single and linear. The post-orbital process is thick, convex above, and bent downwards at the tip. The premolars approximate each other, and are large. The sectorial tooth is in the same line as the other teeth. The internal palate is narrow. Gray makes the distinction between the present and the following species that this has the "*upper sectorial tooth moderate.*"

THE RED WOLF (*Chrysocyon jubata*).—This is the Loup rouge of the French, and the Agūarâ guazú of the Guaranese or native population of Central South America, which signifies a great Fox. The Chilians call it Culpéu, and Maximilian describes it as Canis campestris. It inhabits the extensive lowlands of Paraguay, where the numerous streams render it almost a necessity to take frequently to the water; it is, consequently, a good swimmer. Its long legs give it a peculiar aspect when walking, as it strides off with the swinging motion of a large Newfoundland Dog. Its voice is *gouaa*, repeated frequently and loudly, and is heard at great distances. There is no very marked differences in the sexes. In habit it is solitary. Azara gives the following description: "The length is exactly five feet; the tail nineteen inches, the hairs measuring nearly four inches. It stands in front two feet ten inches and a half; behind, two feet eleven inches. The ears are six inches high, the broadest part four inches; they are not, properly speaking, sharp, but erect and very thick. From the tip of the muzzle to the ears it is nine inches and three quarters; to inner angle of the eye, five inches. The whiskers are two and a half inches long, black in color. The upper jaw projects an inch. The canine teeth were ten lines long, though much worn. The eye is small and sunken. From the eye, forward, the muzzle is almost equal thickness to the tip. The female has six mammæ. Underneath the neck is a large white spot; the long hairs within the ears, and the extreme half of the tail, are likewise white. The fur and hind-feet to the claws, the lower jaw from the corner of the mouth forwards, and the extremity of the upper one, are all black; the rest of the coat is a clear, somewhat yellowish-red color. The mane commences on the occiput; it continues erect till it passes the shoulder; it is five inches and three quarters in length, and of the above-mentioned red color in the basal half of each hair, and the remainder to the tip is black. The hair all the body over, including the belly, with the exception of the inferior part of the fore-legs, is very long; on the extremity of the spine it is four inches and a half; it is neither completely flattened nor very rough, and would make excellent carpets. The hair of the tail is rather bushy, and of the same length as that of the body."

Fox-Tailed Wolves.

Individuals of this group are characterized by an elongated tail, which reaches below the heels, and is more or less curved, and covered with more or less elongated hair, not forming a full brush.

Lycalopex.—*Burm.*

In this genus the pupil is circular, and the tail reaches below the hocks. The upper tubercular teeth are oblong, and together are much longer than the flesh tooth. This genus was instituted by Burmeister in his *Fauna Braziliana*.

THE VETERAN (*Lycalopex vetulus, Burm.*)—As no trivial name is given this species, and as it is to be presumed that the specific term vetulus is applied for some good and sufficient reason, we venture to extract from its Latin root the above designation. The casual or lay reader must have a name. The tail of this species is very long and bushy. Under side of

body a pale yellow color; the snout reddish-brown. The coronal ridge is narrow and linear. Maximilian regarded this species as Canis azaræ. It inhabits Brazil.

YELLOW-TAILED WOLF (*Lycalopex fulvicaudus, Burm.*)—Again we apply a name extracted from the specific designation of Burmeister, the under side of the tail being a reddish-yellow or fulvous. The temporal muscles are separated by a well-marked, narrow lanceolate crown, which is linear for one fourth of its length behind. The upper sectorial tooth is short, broad and thick; the upper tubercular teeth are large, and nearly similar in size and form. This is called by one author Canis fulvicaudatus. Its habitat is South America generally. The teeth of these creatures vary in size in the same species. A variety, L. chiloensis, has the upper sectorial tooth compressed, with the inner front lobe rather in front of the front edge of the tooth. The crown of the skull is flat and narrow, and sub-vase shaped; the hinder opening of the palate, broad and expanded. Waterhouse called this Vulpes azaræ, and Gerrard, V. vetulus. Its habitat is Chiloe.

PSEUDOLOPEX.—*Burm.*

This genus has an elongated tail, reaching below the hocks. The pupil is elliptical in the daylight. The skull has a linear coronal ridge. The upper tubercular teeth, taken together, are scarcely so long as or very little longer than the flesh tooth. Two groups are noticed in this genus; the following has the fore-legs gray externally, and soles of the feet a blackish-brown.

THE AGOUARACHY (*Pseudolopex azaræ, Burm.*)—This is the most familiar species of the tribe. Maximilian described it, as well as the two preceding species, under the present specific name. Gray and Vanderhoeven also called it the same; Schinz had it Canis braziliensis, and Wagner, C. melanostomus. The eminent naturalist, Azara, was honored by the present nomenclature. The first portion of the trivial name is synonymous with raposa, fox and zorro—local designations; the terminal, "chay," being regarded as only added to distinguish it from the native name of Canis jubata. Its range is from Brazil, through Paraguay, to Patagonia; Darwin met with it in the latter region. Mr. Waterhouse, in a communication to the Zoölogical Society of London, speaks of this Fox-tailed Wolf as smaller than the C. magellenicus, and less common and mischievous, more shy in manner, and as confining itself more to the lower parts of the country, inhabiting the provinces of Valparaiso, Aconcagua and Colchagua. It is well known to the natives under the name of Chilla. The tubercular molars are three in number, the front always the largest. Azara describes this species as follows: "The ear is three and three-quarter inches in height, and two inches in breadth at the base. The head is six inches long; at the broadest part it is three and a half inches wide. The ears are two inches apart, which distance is reduced to less than half at pleasure. The canines were six lines long, though worn. It has three pairs of mammæ. The hair on the loins and tail is three inches in length; on the muzzle and ears, very short. The outer part of fore-leg, as far as the claws, reddish-cinnamon in color, like the outer part of the ear; the hind-leg, to within two inches of the claws, the same. The muzzle, as far as the eyes, is blackish, and the remaining parts of the head are covered with cinnamon-colored hair, with white tips. The lower jaw is black on the under parts, and the remaining parts under the head are white. All the inferior parts of the body, with the inner parts of the hind-legs, are whitish, although in reality the tips of the hairs are white, and the inner parts dark. The rest of the coat is a mixed gray, proceeding from each hair, having two white and two black bands, the tips being of this last color, which predominate greatly in the loins and tail. The tip of the former is almost black. In addition to what is stated above, there is another interior coat or down of a white color, very soft, one inch long. The young at first are almost entirely black."

GRAYISH-YELLOW WOLF (*Pseudolopex griseus, Burm.*)—This is one of the second group, which have the fore-legs entirely red-yellow, and soles of the feet red-brown in color. The fur is a reddish-yellow-gray. The body is small. It is the Canis griseus of Gray, and Vulpes griseus of Gerrard. Habitat, Patagonia.

THE COLPEO (*Pseudolopex magellenicus, Burm.*) is one of the same group as the preceding, but much larger. It has a red fur, the back being black. Waterhouse called it Canis azaræ; Molina, C. colpaceus; Mayer, C. tetradactyla; and Shaw, the Chili Fox. It inhabits Chili and Bolivia, and Darwin saw it in the Straits of Magellan.

THE ANTARCTIC FOX (*Pseudolopex antarcticus*).—This is pretty well known to voyagers to the South Pacific. Darwin, in *Voyage of the Beagle*, mentions it, and predicts its entire extinction from the Falkland Islands—its most notable habitat. It is very circumscribed in range, and is seldom seen elsewhere.

THE SLENDER FOX (*Pseudolopex gracilis, Burm.*)—This is another form recorded by Dr. Gray without any convenient popular designation. It is presumed to be somewhat more graceful or slender than others of the group, otherwise it is inconceivable why it is called gracilis. Burmeister describes it in *Reise La Plata*, vol. ii, p. 406. It is also mentioned in *Arch. Naturg.*, 1862, p. 130. It inhabits the Pampas of Mendoza.

THOUS.—*Gray.*

This genus was originally a part of Lycalopex, but is instituted separately to include two species. The skull is elongate, the nose tapering and moderate in length. The temporal muscles are separated by a base-shaped crown. The teeth are forty-four in number—twenty on the upper and twenty-four on the lower jaw. On each side of the upper jaw are two tubercular grinders, and three in each side of the lower jaw. The two hinder are circular, the hindmost very minute.

THE CRAB-EATING FOX (*Thous cancrivorus, Desm.*)—Mayer, in *Zoölogical Annals*, calls it Viverra

cancrivora. Lund, in his work on Brazil, names it Canis braziliensis; Wagner, C. melampus; Buffon, Chien des bois; other authors, Chien sauvage, Canis thous and Surinam Dog. Its habitat is mostly Guiana, where it roams in small packs. A specimen in the Museum at Central Park, N. Y., gives the habitat as New Grenada. Its general aspect and color is somewhat that of the Jackal, though considerably more slender.

YELLOW-LEGGED FOX (*Thous fulvipes*).—This is described in *Proc. Zoö. Soc.* for 1837, by Martin; by Waterhouse, in *Zoölogy of the Beagle;* Gerrard, in *Catalogue of Bones of Mammals;* and by Burmeister, in *La Plata and Arch. Naturg.*, 1862. Its habitat is Chili.

THE ALCO (*Canis familiaris*).—Among the numerous domesticated Dogs that inhabit every quarter of the globe, this little creature is preëminently interesting, and particularly from the fact that it is quite easily traceable to its native indigenous progenitors. There is evidence that two distinct breeds of indigenous *Canidæ* were living in the West India Islands at the time of their discovery, and that the common name Alco was a generic term applied to both. One breed—the silky-haired Alco—was probably introduced from Yucatan and Mexico, the seat of Indian civilization. The other breed—the short-haired—came from the Southern Spanish Main by the predatory Caribs. A variety, called the Mexican Mopsey, differs only, from the detailed description of Buffon, in having woolly instead of silky hair. Bryan Edwards, in his *History of the West Indies*, quotes an author named Acosto, who says: "The Dogs among the Indians of St. Domingo were a small mute creature, with a nose like that of a Fox, which the natives called Alco. The Indians were very fond of them, carrying them on their shoulders." The Mexican Mopseys are often so formed. "Of the three different species of Dog included by Fernandez, in *History of the Animals of New Spain*, under the generic name Alco, Buffon, rejecting at once the hairless Dog, identical with the Bald Turk of the Old Continent, admits readily the species called Ytzcuinte potzotli—a Dog, short-necked in an unusual degree, and humped in shape, with silky hair—and the Techichi, wild and melancholy in aspect, as true aboriginal Dogs. The first of these two species he recognizes as the same with the Lap-dog of Peru, and the other as a larger and lighter-made species, but dull and spiritless, which the Indians make use of in the chase, in which he sees the Forest Dog of Guiana." Mr. Philip Henry Gosse, from whose work, *A Naturalist's Sojourn in Jamaica*, the above is derived, met with one of the white, silky Lap-dogs at Spanish Town, which he considered to be the true native Dog, Mexican Mopsey or Alco. He was here informed that "the Gaschis of Charlevoix, and the Gasques of Garcilasso and Peres, described as small dogs, absolutely mute, with downy or silky hair of different and often of bright colors, possessed by the natives of St. Domingo and the neighboring islands, and used in the chase of their almost only quadruped, the Agouti, before the arrival of the Spaniards, was a dog of the Alco race. The best-known variety of the Indian Alco is the woolly breed, so much sought after under the appellation of the Mexican Mopsey." The informer above-mentioned says, further: "I should not forget to mention that there is a wild Dog in Eastern Haïti, very different from the Feral Hound of St. Domingo, delineated by Col. Hamilton Smith. This wild Dog is called a Xibaro (Hībărŏ), and at all points resembles the Aguara Dog of Surinam. Tradition makes them Indian. They maintain a uniform character in every district in which they are known."

FAMILY—FELIDÆ.

Members of this family have the head short and broad. The feet are digitigrade, with five toes on the fore-feet, and four on the hind. The claws are retractile and sheathed. The molars, including the premolars, are $\frac{4}{3}$–$\frac{4}{3}$ or $\frac{3}{3}$-$\frac{3}{3}$; the incisors are $\frac{6}{6}$. The posterior upper, or true molar, is very small. Cats are especially distinguished from the Dogs by their retractile, sharp and compressed claws. The number of toes on each foot, respectively, is the same as in *Canidæ*. The tongue is peculiar in its armament of sharp-recurved prickles. There is a close uniformity in the osteological characters of this family, particularly in the structure of the skull and teeth. Two groups are, however, recognized among the American *Felidæ*. One has compact fur, a lengthened tail, high shoulders, and the jaw armed with four molars above. The other has loose, often long hair, with less beauty and gloss; the tail is truncated; the ears are tipped with pencils of long hair, and the hind-legs are higher than those of the preceding; three upper molars on each side. This includes the tribe of Lynxes; the other, the Cats proper, Felis.

FELIS.—*Linn.*

This genus, which includes the typical Cats, is characterized by a very small anterior premolar, and a tail which equals in length one half that of the body. Five species of true Cats are known to inhabit the United States, all inhabiting the region of the lower Rio Grande, the F. concolor having a much larger range. The dental formula of the Cats is: Incisors, $\frac{3}{3}$–$\frac{3}{3}$; Canines, $\frac{1}{1}$–$\frac{1}{1}$; Premolars, $\frac{3}{2}$–$\frac{3}{2}$; Molars, $\frac{1}{1}$-$\frac{1}{1}$ = 30.

THE AMERICAN PANTHER (*Felis concolor, Linn.*)—Plate I., fig. i.—This is the largest and most powerful of North American Cats, if we except the Jaguar, which is more properly a southern species, well known in nearly all portions of the country as the Panther, Painter, American Lion, Cougar, Puma, &c. Cuvier and St. Hilaire called it Le Cougouar; Azara, Guazuara; and Margrave, Cuguacuarana. It reaches in size the dimensions of the largest Dog, and weighs, in some instances, 150 pounds. It is found from the Straits of Magellan to the fiftieth parallel north, particularly in a line with the mountains. It is cowardly, though possessing great strength and ferocity, approaching its prey always stealthily, and retreating readily from the face of Man. De Kay

relates an instance of a hunter having captured two cubs, while the mother followed without making any attempt to attack, and finally disappeared on reaching the vicinity of the settlement. The natural habit of the Puma is to lie in wait upon branches of trees, and from thence to spring upon the prey. Some authors assert that the creature purposely pounces upon the shoulders, and forcibly draws back the head to dislocate the neck. Certainly it frequents the larger trees, and quickly seeks shelter in the branches when met by Man.

Like other Cats, the Puma swims, though deeply, on account of its compact bulk; and instances are recorded of individuals crossing from the mainland to Terra del Fuego. We knew one instance of a Puma which had crossed from the mainland to one of the cays or islands of the Florida Reef, and the havoc which it occasioned for a distance of several miles, in various places, and on different cays, which were separated from each other by wide and deep channels, showed plainly that the creature took very readily to the water. It was in November, a pleasant season to visit this sub-tropical region. We were engaged, with a party of United States officers, detailed from Forts Taylor and Jefferson, for the purpose of surveying the long line of coral islands which extend from Tortugas to Cape Florida. It was just twilight—that period in the tropics between daylight and dark that surprises every new comer by its extraordinary brevity. We had tramped wearily along the extended beach of Plantation Cay, and had come suddenly, about midway of the island, upon large tracks in the moist sand. Some great beast had, evidently, at this point, emerged from the thicket of mangroves. Here was a chance for our ambitious hunters. We measured the tracks; they were four inches wide by four and a half in length; they were those of a Feline, and, consequently, none other than those of the Puma, for a large Dog would leave marks of the non-retractile claws, and no other northern Carnivore is so large. We soon arrived at the eastern end of the island, to which point the tracks were continuous, and where, in the ripple of the sea border, they vanish; evidently the creature had taken to the channel and swam to the neighboring cay. Night closed in upon us; the mangroves were here replaced by larger trees, and the deeper soil bore forth a rank growth of grass and shrubbery. In the dense mass of foliage, we discerned a light, which came from a wrecker's hut, the only human habitation we had met with on the reef. The surroundings were exceedingly sombre and suggestive. As is common near tropical homes, however humble, the cocoa-nut palm was here preëminent, rearing its grand plumes above the dark background, and relieved against the star-lit sky, in all the beauty of its flowing leaflets. The dense undergrowth, cavern-like, where, in the clearing, stood the rude habitation, reflected fitfully the lurid blaze of the camp-fire; the broad, glossy foliage of the banana sparkled with the play of light; the fire-flies, here and there, flecked the broad hiatus of darkness; while the wreckers, whose scared looks were quite in unison with the scene, gazed furtively about them, and rehearsed to us their tale of wonder. Their simple ignorance allowed full play to credulous surmise and alarm. Though the Puma is well known to the inhabitants of Upper Florida, it is very seldom seen on the islands of the reef, and these simple wreckers were utterly confounded with fear. Some "enormous creature had pounced down upon the cabin," and the two mangled pups which we saw there attested plainly that mischief had been attempted. The men had mustered courage enough to chase the creature, whereupon the pups were abandoned. The fact that the tracks disappeared at the edge of the cay, in direct line with the next nearest, was evidence that the creature had gone on for further plunder. Our party returned to the vessel to sleep over this exciting matter, and to make ready for a stalking hunt on the next night. Morning come, we were on shore at Metacombe Cay; the tracks were visible here, too. Puma had swum directly across from Plantation Cay. After a day's work along the shore, we reached the eastern end of Metacombe, where another brace of wreckers were encamped. Here was the same story of rapine and bloodshed. During the night, the Puma had visited the hog-pen of the establishment, and, curiously enough, instead of leaping over the low bars of the pen, had deliberately bitten off a large piece of plank, and, seizing one of the hog's ears, made off with it. The muscular power and strength of jaw required to accomplish this feat upon so stout a plank must be enormous. It was now proposed to build a fire near the hog-pen, and retire for the night in the wreckers' cabin. A board was placed across the door-way, behind which Pablo, our cook, was to take the first watch; he was charged with strict orders to call the party on the first signs of the enemy. Sleeping was a thing nearly impossible, for the mosquitoes were present in clouds. Near midnight, when the nearest approach to sleep had been attained, the report of Pablo's rifle called every one to the front. The negro had lost all caution, and blazed away at the first sight of the beast. Several good shots, however, were up in good time, and we had the satisfaction of taking the measurement of one of the largest of his kind—a male Puma. His appetite had been sharpened by fasting, and the several attempts made to carry off his prey only resulted in whetting his desires for more, and thus it was a pretty safe conclusion to make that he would return for another attempt after tasting so daintily of the porker's ear. He had crept stealthily along, and was just in sight, near the fire, when Pablo's shot caused him to leap with a prodigious bound over the fire-brands; but a second shot ended his career. Instances are not uncommon in Upper Florida of this animal's disposition to enter human domains. We have heard authentic reports of children being seized from the fields where the parents were at work.

The Puma is occasionally killed in the Adirondacks, and the trivial name Painter, a corruption of Panther, has given, more than once, opportunity for amusing misapprehension. A timid cockney, who affects the two-fold accomplishment of "artist and

sportsman," armed and equipped with the best approved gear and tackle, with portable camp-stools, easels, and all the paraphernalia so delectable to the craft, inquired, with much assurance, if there "was much, if any, shooting hereabouts." "Oh, yes," said his guide, "pooty tol'able, now and then a Painter; several on 'em killed this season." The prowess of the artist-sportsman, as we may conceive, was marvellously tried by this answer. One of the largest male Pumas we have ever seen was at the establishment of Mr. Bell, the New York taxidermist; it was shot by one of the engineers engaged in a survey of the Adirondack region. Several fine specimens are kept in the Zoölogical Collection at Central Park, where they have repeatedly bred, giving birth usually to two. De Kay says: "When a boy, I remember the consternation occasioned by the appearance of one of these animals (the Puma) in Westchester County, not more than twenty-five miles from New York." In the early settlement of the State, the animal was believed to be a Lion. In Vanderdonck's *History of the New Netherlands*, the author says, "Though the country is fierce in climate, and in winter seems rather cold, nevertheless, Lions are found there, but not by the Christians, who have traversed the land without seeing one. The females are only known to us, and those only by the skins; the males are too fierce and active to be taken." The Puma is occasionally seen in the Catskill Mountains, and particularly in the counties of Herkimer, St. Lawrence and Hamilton, N. Y. Individuals have been shot in Vermont, and a few have been seen and captured in Massachusetts. It is rarely seen farther north than New York.

THE JAGUAR (*Felis onca, Linn.*)—Fig. 36, vol. i, p. 116.—This magnificent Cat exceeds in size, strength and beauty all other Carnivores of the continent; indeed, these special attributes have gained for it the title of American Tiger. It is found as far north as Eastern Texas, extending to Red River, and south through Paraguay and Brazil. Its westernmost limit, according to Mr. Weyss, is the Gaudeloupe Cañon (Sierra madre). The Apaches call it Tutinquillé, and the Mexicans, Tigre. The Jaguar is the representative of the Leopard on this continent, and, though larger, is very closely allied to it.

In the Zoölogical Collection at Central Park, N. Y., are several fine full-grown Leopards of both sexes; there have been at various times very beautiful specimens of the Jagnar, also adult, and of either sex. We have been very familiar with the various aspects of these creatures, regarding them, as they are stationed near each other, with critical attention. It is difficult to point out any very marked difference between them, excepting, of course, the very notable one of angular and spotted rings. The head of the Jaguar is rather longer, and the visage is less amiable; there is also a general expression of muscular power, which, in the Leopard, is concealed by a roundness of outline in every part. These features, however, may not be noticeable in the wild state. The tail of the Jaguar is shorter than that of the Leopard, reaching the ground only as it stands upon all-fours. On the breast of the former are two or three prominent black marks, which are not seen in the Leopard. Some individuals—and one notable example we have seen in the Central Park Collection—have the skin most brilliantly colored, the ground being of the richest golden sheen, upon which the deep-black rosettes contrast most admirably. A black variety is not uncommon, wherein the spots are still visible, though the color of the fur is very nearly uniform; this is due, probably, to a melanotic condition, which is supposed to be induced by the presence of too much iron in the blood. An opposite state is that of the albino—one in which there is complete absence of coloring matter in the skin and certain other tissues; the eye, for example, is red in the latter, owing to the delicate membranes having no coloring but that given by the presence of red blood. Two fine specimens of the Black Jaguar are in the American Museum, Central Park, N. Y. It is the general impression that the Jaguar, as well as the Puma, is intractable and untamable, but instances are extant of both creatures being tamed and made quite docile. A specimen of the Jaguar, taken to England by Capt. Inglefield, of the British Navy, proved so thoroughly good-natured that it was to its keepers all that any domestic Cat may be. "It was playful, and was as mischievous in its sport as any kitten, delighting to find any one who would join in a game of romps, and acting just as a kitten would under the same circumstances. As the animal increased in size and strength, its play began to be rather too rough to be agreeable." This individual was two years old when it was taken to England. Two years after its arrival, Capt. Inglefield visited it, when the creature at once recognized its former owner, allowing him to pet it, and exhibiting considerable fondness. The Jaguar will not attack Man unprovoked, but is a fearless and relentless enemy to all other living creatures, excepting the Boa Constrictor. We were told that a large Jaguar, which remained some time in the Central Park Zoölogical Collection, had been kept in confinement many years, and had been the hero of several remarkable tales. At one time, while "on the road" with Mr. Van Amburgh's Menagerie, the cage of a large Boa required some repairs; its glass door was newly set in putty. During the following night, the huge folds of the snake pressed off the glass, and gave speedy exit to the occupant. It was but a coil or so distant from the den of the Jaguar. The huge serpent, now experiencing a realizing sense of the blessings of liberty, quietly and cautiously unfolded a scheme of neighborly visitings. The usual grand rounds of the night-watchman brought him, in due course, to the Jaguar's cage, where a most extraordinary tableau was in progress. The great Cat, whose prowess is not wont to be arraigned for trifles, was crouched in one corner, utterly impotent with fear, and exhibiting in his visage every expression of profound terror and apprehension that brute is capable of, while the stolid, unconcerned serpent lay, all innocent of harmful motive, coiled around the bars of the cage, his head peering in and out of the perilous presence of

the great beast. A bloody tale is related in the *Report of the U. S. Mexican Boundary Survey*. In the year 1824, at the convent of San Francisco, in Santa Fé, a lay brother, who had just returned from his devotions, met in the hall-way of the convent, face to face, an enormous Jaguar. The creature, finding itself cornered, sprang upon the monk, and very quickly killed him. The guardian, aroused by the cries, came at once to the scene, and had scarcely made an attempt to resist the beast before he was mortally hurt. A third person was slain almost as quickly. Mr. Iriondo, a senator of the State, being present, armed several men, and succeeded in driving the Jaguar into an inner room; but, in this encounter, a fourth human victim was sacrificed. A hole was now bored in the door leading to the inner room where the creature had been enclosed, and through that he was shot. The measurement of this Jaguar was five feet from the nose to the root of the tail.

The Jaguar has a reputation for immense physical strength. One instance is recorded of the beast seizing a Horse (after capturing it in the same manner attributed to the Puma—that of leaping upon its neck and forcing the head backwards until the spinal cord is broken), and dragging it to a stream, swimming across, and at last lifting it upon the bank, where it feasted on the carcass. Humboldt regarded the largest specimen he met with as "exceeding in length any Tiger of India which I have seen in the collections of Europe." This Cat seems to understand fully the advantage of "Turtle-turning." The huge Sea Turtle goes upon the sandy beach to lay her eggs; after digging a hole, and laying her "complement," she covers them with due care, and cautiously returns seaward. At this juncture, the great feline, who has wisely overlooked the whole proceeding, now deliberately approaches, and most adroitly capsizes the huge reptile. Once on her back, she is completely helpless. Jaguar is conscious of this, as is the "mariner, who finds his occupation in't." He, therefore, proceeds deliberately to uncover the eggs, then and there indulging his taste with the delicious relish, as *entremets* to the more solid pabulum thus securely in hand. He waives the traditional *first course*, declining *soup* of his Turtle, but may be said to take it *raw on the half shell*. To realize fully how skilfully this Cat separates the flesh from the shells of the Turtle, we should read the accounts of Humboldt and other South American travelers. The sharp claws are introduced between the shells, and every particle is separated. The arboreal habits of the Jaguar fit it for an easy capture of prey from the numerous bands of Monkeys, besides the larger animals, which, we have seen, he does not hesitate to attempt. The Capybara is the most common victim, as it is sluggish and easily captured. The little Peccary gives him infinite difficulty, however, not hesitating to give him battle, and often proving a most deadly foe, instead of an easy victim, which his insignificant appearance betokens. Its sabre like teeth are used with deadly effect, and frequently prove too much for the aggressor. Instances are recorded of birds on the wing being struck down by a single blow of the Jaguar, and fishes are seized from the lake or stream by its nimble talons.

OCELOT, TIGER CAT (*Felis pardalis, Linn.*)—This is the F. armillata of F. Cuvier; F. griffithii of Smith; F. catenata of Griffith; and F. chibiguazu of others. In size it is about that of the Wild Cat. The ears are black, with a white spot. Tail above is black, with narrow white bands. On the back of the neck are fine stripes, with lighter intervals. Along the back is a series of full black blotches, more or less continuous. The rest of the back and sides show a grayish net-work, enclosing angular blotches, more or less elongated, black externally, brownish-yellow in the centre. The blotches next the dorsal line are more serial and smaller. The Ocelot inhabits all of Texas, and reaches north as far as Red River. It resembles, more or less, other South American species. It weighs rather more than F. macroura or F. oceloides. F. mitis is nearer it in size. From the nose to the root of tail it measures twenty-seven inches. Its fur is short, close and glossy. The skin is prized for certain purposes, and often, it is said, commands the same price as that of the Jaguar. The Ocelot is regarded as less amenable to cultivation or kind treatment; fierce and treacherous in the wild state, it scarcely becomes a safe or attractive pet when kept in confinement. It is surly and capricious, growling fiercely and spitting when the cage is approached. At times, or perhaps more particularly with certain individuals, it purrs and exhibits something like a pleasant temper.

TIGER CAT (*Felis eyra, Desm.*)—Berlandier obtained a specimen of this Cat in Matamoras, and, on the strength of this, Prof. Baird enumerates it with the North American *Felidæ*. It is the size of a common Cat, but longer in body; its neck is much longer, and its general form is musteline. The tail is rather longer than the body. Its color is a uniform brownish-red, a little paler beneath; the hairs are not mottled. Its head is small; the ears are short, without tufts; the body is slender. Dr. Berlandier tamed one to a certain extent, but there seems little evidence in favor of their proving acceptable pets. In the desolate regions of Tamaulipas, and in Guiana, Brazil, Paraguay, and the Rio Grande of Texas, they abound.

THE YAGUARUNDI (*Felis yaguarundi, Desm.*)—This is larger, somewhat, and decidedly longer than the common Cat. The tail is as long as the body, exclusive of the neck and head. The prevailing color is a uniform grizzled brownish-gray, with no spots or markings. The hairs are annulated and tipped with black. The young are more rufous. It is the F. mexicanus of Desm., and F. cacomitl of Berlandier. The latter author procured a specimen in Matamoras, which fact establishes the habitat of the animal farther north than it had hitherto been known to live. Paraguay is said to be its southern limit of range. With the Puma and Lynx it exhibits a striking contrast to all other members of the family by its plain, uniform color.

THE MARGUAY (*Felis tigrina*).—This is one of the handsomest of the smaller Cats common to

tropical America. It is beautifully marked, and is said to become a pleasant pet when tamed. Mr. Waterton speaks of taming one so that he was as docile and as safe a pet as the domestic Cat. The ground color of this species is a bright tawney; the face is striped downwards with black; the shoulders and body marked both with stripes and large, oblong black spots, and small spots on the legs. The breast, belly and insides of the limbs are whitish. The tail is long, marked with black and gray. Its habit is arboreal, mostly watching its prey from the branches of trees in the deep forests. Its young are two in number. It breeds once a year.

THE PAMPAS CAT (*Felis pajeros*).—This is about the size of a large house Cat, measuring about twenty-six inches in length. It is strictly a South American species, though it ranges the entire Southern continent. The fur is long, of a pale yellowish-gray color generally, with the sides of the body banded with brownish tinge. The tail is peculiar, being short and bush-like at the extremity.

THE CHATI (*Felis mitis*).—This is little larger than the preceding, measuring about three feet, the tail included. Above, the fur is pale yellow, with dark brown irregular patches; beneath, it is white. Beneath the throat there are two bands, crescent-shaped, having the aspect of collars. The tail, toward the tip, has a series of faint rings. The Chati is found in South America exclusively, and is said to be gentle and tameable.

THE CHIBIGUAZU (*Felis chibiguazu*).—This Cat is larger than the preceding, measuring four feet, including the tail, which is about thirteen inches long. It is said to be unusually cunning and destructive, yet, when kept in confinement, becomes tractable and docile. Other species are known to inhabit the tropical regions of South America, but little is known of them. Felis hernandezii is found in Mexico; Felis colcola, Guiana and Surinam; F. geoffroyii, the Pampas and Patagonia; F. grisca (Gray ocelot), Central America; F. jacobita, Bolivia; F. pictus of Gray and F. pseudopardalis are from the Bay of Campeche.

LYNX.—*Raf.*

Dr. Gray and De Kay, in the *New York Zoölogy*, use the term Lyncus for this genus. Its characters are seen in the absence of the small anterior premolar and the brief and abruptly truncate tail. There are, besides, certain differences of structure in the cranium. There are four forms of this genus in the United States.

AMERICAN WILD CAT (*Lynx rufus, Raf.*)—The specific characters of this form are given as follows: "The fur moderately full and soft; above and on the sides, pale rufous, overlaid with grayish—the latter color most prevalent in winter; a few obsolete dark spots on the sides, and indistinct longitudinal lines along the middle of the back; color on the throat like the sides, but much paler; beneath, white spotted; inside of the fore and hind-legs, banded; tail with a small black patch above at the end, with indistinct subterminal half rings; inner surface of ear with a white patch."—*Baird.* The same authority remarks, concerning the difficulty of determining the subject of species in this genus: "In the study of the North American Lynxes, although a considerable number of specimens have been before me, I have found it difficult to come to satisfactory conclusions, owing to the imperfect condition of some and the uncertainty as to date of collecting others. It is well known that this species, having a very wide range, varies much, not only with locality and season, but those from different localities will vary much at the same time. Northern skins of Wild Cats have generally longer and softer hair the year through than the southern, while, as in the Deer, the hair will have a reddish or bay tinge, which is replaced by a grayish in winter. In many of our animals of wide distribution, there appear to be several races, as far as dimensions are concerned, in particular species; skulls of the same relative age being different in size. This is particularly the case in the Cats, Raccoons, Bears and Deer; and, as a general rule, the farther south we go, the smaller the species. This condition of things adds not a little to the confusion which prevails. The skulls vary much, too, with age, and probably also with sex, although the specimens before me, not having the sex indicated, do not afford the clue to the peculiarities of male or female. There appear to be at least three species of smaller American Lynxes in North America—the common Bay Lynx, which reaches from the Atlantic to the Pacific, throughout nearly the whole latitude of the United States, but is replaced in Texas and Southern California by the Lynx maculatus, and in Northern Oregon and Washington Territories by the L. fasciatus. The precise limit of the last-mentioned species, other than as indicated, has not been ascertained. The examination of a large number of well-prepared specimens of different ages, sexes, seasons and localities will, however, be necessary fully to unravel the perplexities which now encompass the whole subject."

Specimens of this form are in the Smithsonian Institute, from Carlisle, Pa.; St. Johns, Florida; from Nebraska, California, Oregon, Missouri and Alabama. This Cat is frequently captured; several fine specimens are kept at Central Park, N. Y. They are not sociably inclined, seeming better pleased to retire from sight; spitting and snarling when approached, and constantly wearing a thoroughly forbidding and sinister countenance. Measurements are given as follows: Length of head and body, twenty-eight and three-quarter inches. One was twenty-seven inches. The tail of former is seven inches. Height of latter at shoulder, fifteen and a half inches. Authors have given it various names: F. ruffa by Guilderstaedt; F. rufa, Schreber and others; Lynx montanus by Raff. and Harlan; L. floridianus by Raff.; Bay Cat and Mountain Cat by Pennant.

TEXAS WILD CAT (*Lynx rufus, var. maculatus*).—Baird gives the specific characters of this Cat as: "Fur short and rather coarse; color above and on sides, light reddish-brown, overlaid with grayish in the winter; quite distinct spots of darker on the

back and sides; color on the throat paler than sides; beneath, white spotted; inside of legs, banded; tail with a small black patch at the end above; inner surface of ear black, with a white patch. In addition to the markings described there is an obscure dark line along the sides of the neck, starting below the ear, and two rounded black spots between the anterior extremities of these lines, which diverge slightly from each other. The ears are quite large and pointed. The prevailing color above is a chestnut-brown, darkest on the vertebral region; this is, however, imparted by a large number of crowded, rounded spots, between which the color is lighter." Measurement given is three feet from nose to root of tail; tail vertebræ, five and three-quarters inches; tail, including hairs, six and a half inches. The Mexicans call it Gato montes; the Yuma Indians, No mé; the Cochines of California, Chimbi. Its voice is likened to the Puma, when enraged. Mexico, Texas and California seem to be the favorite localities of this variety.

RED CAT (*Lynx fasciatus, Raf.*)—This is the TIGER CAT of Lewis and Clark. It is described as having a very full and soft fur, and pencilled ears. The back is of a rich chestnut-brown color, a little paler on the sides and on the throat, which has a darker band on the dorsal portion. Along the central line of the belly is a dull whitish tint, with dusky spots, extending to lower part of sides. No spots or bands are to be seen on the upper part of the sides. Ears are black inside, with a very inconspicuous patch of grayish. Terminal third of tail above, black. This species is considered remarkable for the softness of its fur, and resembles, in that respect, the L. canadensis. It is rather distinguished from others by its rich chestnut color. It was first described by Lewis and Clark, in their report of 1814. Its habitat is mostly in the regions of the northwest. Its dimensions are much the same as others previously mentioned.

CANADA LYNX (*Lynx canadensis, Raf.*)—This Lynx is the largest of all the North American species. It is quite easily distinguished by its general aspect of bulkiness; its feet are larger, and the longer hair gives a stouter look to the limbs and body. The neck has a pointed ruff on each side. The tail is very short, but densely covered with hair. The general color is gray, sometimes being quite whitish. The pencils on the ear tips are black and very prominent, being about two inches long; and the extreme tip of tail is black. Along the margin of the ears the hair is black. The head and body of this Lynx is thirty-four and a half inches in length; the tail vertebræ, four and a half inches; tail, with hairs, five and three-quarters inches. Some doubt exists among European authors concerning the identity between this and the European species—some claiming them as one species. This is the Loup cervier of the early French writers, and the Big Gray Wild Cat of the New York hunters. Godman calls it the Northern Lynx, and De Kay adopts this as his trivial designation, and Lyncus borealis as the systematic name. It is, perhaps, better known as the Canada Lynx. In the northern districts of New York State it is not uncommon, where it preys on the Hare and other small quadrupeds, occasionally venturing into the farm-yards to seize upon young pigs, lambs, &c. It is regarded as a timid animal, and one that is easily destroyed. Its locomotion is rather peculiar, consisting of a series of leaps, alighting on all-fours at each bound. It swims well, taking to the water readily. It breeds once a year, having two at a time. No Lynx has been found in South America, though some of the species extend their range pretty well down in Central America.

ORDER VI.—PINNIPEDIA.

SEALS.

ANIMALS having fin-like extremities—"flippers," so called by the "toilers of the sea"—are, in the nomenclature of science, Pinnipeds, or designated as a whole group, *Pinnipedia*, from the Latin, *pinna*, a fin or wing, and *pedia*, from the noun *pes*, a foot; hence, fin-footed. They are, on a general view of Mammals allied to them on either hand, so far as the appearance of the skeleton goes, on a middle ground, the Whale, an air-breathing mammal, being a few grades less perfect in its bony structure, having for instance no hinder extremities, but supplied with an external development of the muscular tissues that quite simulates the fin of a fish, though it is horizontal, instead of vertically placed as in fishes. On the other side the Otter, especially the Sea Otter, is a degree more advanced towards the typical vertebrate Mammal. Seals are not numerous as species; not over thirty have been enumerated. Dr. J. E. Gray distributes them into thirteen genera. Two species are found in the West Indian seas; the remainder are confined to the colder portions of the globe. Most of those found in the southern hemisphere differ somewhat from those of the northern regions, not only in species, but in belonging to different groups. The Seal is adapted, to a certain extent, for terrestrial locomotion. The muscles of the trunk are enormously developed to aid the weaker anatomy of the extremities. Ample opportunity is, of late years, offered to witness the progression of these creatures; several species of them are kept in public collections very successfully. The method of their progress is much like that of the Surveyor, or Inch-worm. The hinder extremities are drawn forwards, and placed with their extended webbed feet flatwise upon the surface; the body is now thrown out to its utmost tension, the "flippers" or forward limbs aiding somewhat to break the fall and to grasp the surface. The main exertion seems to be expended in the latter third of the body, which curls under with the feet, both together forming a sort of C spring, the muscles of

which being contracted are, at the moment of progression, suddenly elongated, which results in a jerk or push forwards. The whole action is seemingly laborious, and is exceedingly uncouth. All forms of the Pinnipeds are voracious to a great extent, spending a large portion of their time in securing food; the remainder is passed in basking in the sun or sleeping. Virgil has it:

"Sternunt se somno diversæ in littore Phocæ."

During warm days of sunshine, Seals are often killed while sleeping, though it is recorded that they habitually "sleep and wake alternately about every 180 seconds." It is said by many observers that, while a herd of Seals lies at rest, sleeping, sentinels remain on guard; and, curiously enough, these sentinels in many instances are females. Notwithstanding the apparent solidity of the Seal, observers, as old Seal-hunters, assert that it often sleeps while lying on its back on the surface of the sea. Fabricius and other naturalists mention this as fact. In one instance, a steamer ran directly against one before it awakened. A singular tenderness is noticed in the nose of these creatures, and, in the Seal-fishery, it is taken advantage of. A light blow on this organ disables them; and this allows the fisherman to procure a large number before they can get to their holes and disappear, as they do not recover quickly. The cranium of the Seal is much thinner than that of other *Carnivora*, and the nasal bones are quite delicate in structure, which may account for the peculiar vulnerability of this point. Even the ancients knew of this fact; a passage in *Oppian* alludes to it—"*Non hami penetrant phocas*," etc.

The voice of the Seal is something between the cry of a young child and the bleating of a lamb or kid. There were a dozen or more wild Seals (*Phoca vitulina*) brought to the New York Aquarium in the winter of 1877. The keeper, I noticed, handled them very familiarly, yet, while doing so, they snarled and seized the staff which he held with a good deal of savageness, and kept up a sort of growling which very closely resembled the voice of a cross dog under such circumstances. Seals are said to be fond of music, and it is also credited that Seal-fishers take advantage of this fact to entice them within reach of their weapons. Mr. R. Brown, F. R. G. S., relates that he has "often seen them raising their heads above water, listening to the sea-songs of sailors, as they worked at the capstan or pumps, or tracked the ship to the ice-floe." The tuneful Orpheus, whose powers are said to fail in holding the Dolphin entranced, may yet be said to captivate these, the more susceptible and intelligent of ocean's denizens. The ancients, too, were aware of this propensity to listen to sweet sounds. "*Gaudebant carmine phocæ*" is a familiar line to the classical scholar. Sir Walter Scott has given us his mite in this Seal literature—

"Rude Heiskar's Seals, through surges dark,
Will long pursue the minstrel's bark."

Seals move rapidly in the water, often on their backs or sides, and frequently with the feet and "flippers" closed snugly to reduce the body to the minimum of slenderness. It requires "rapid transit" to pursue and catch fishes of the kind they are accustomed to feed upon in the great tanks of the larger aquaria, but they seldom fail to procure enough to satisfy them. We were greatly amused on witnessing the Seals at Coney Island Aquarium, where, in a large tank, two were confined. A raft was anchored in the centre, on which the creatures basked and rested when out of water. Numerous small fishes (Tom-Cods), from three to six inches in length, were grouped in apparent terror along the borders of the raft, seemingly on the alert, and quite unwilling to trust themselves out of the shelter of its kindly neighborhood. The Seals, evidently distrustful from unsuccessful attempts at their capture, would lie with their mouths nearly touching the fishes, their large lustrous eyes peering at them wistfully, the latter, in shoals, swaying over and around them, secure in the feeling of association and the knowledge (?) that their movements in this situation are too quick for the enemy's present possibilities. Let one finny individual leave his companions and take to the open "field"; the Seal quickly shoots forth, dart-like, flashing like a gleam of light, and pretty surely seizes his prey. Then he has acquired an impetus that equals, it seems, that of the fish, for it was a fair chase, involving a zigzag course, and an occasional *doubling*—such as the Hare so successfully enacts when closely pressed.

Notwithstanding the delicate nature of the Seal's nose, the creature is very tenacious of life. Instances are recorded of the carcass, deprived of its skin, contracting sufficiently to rotate the pelvis upon the spine, upon its being irritated; this is, however, a matter of reflex nervous action. The creature is killed with difficulty, requiring a bullet through the heart or brain.

The common Seal of the Arctic regions is known to the Eskimos as Nutchook, and is the staff of life to them. Ninoo is the White Bear. It is said that it is very difficult to get within rifle-shot of the Seal; but Ninoo has such winning ways that Nutchook even comes to his arms to be hugged. Here we see the power of music again, or the seductive influence of something much like it. Ninoo is aware of the Seal's habit in sleeping with regular intervals of "cat-nap" length, and, on discovering one, lies closely on the ice, now creeping stealthily on his belly during the period of the Seal's repose, now hugging the ice in the minimum of bulk, while Nutchook rouses to look abroad. At the moment when the Seal discovers the Bear, or the mutual recognition passes, Ninoo soothingly gives voice; it is quite distinct from his ordinary utterance; he "talks" to Nutchook, say the Eskimos. It simply charms, and the "cat-nap" comes again. Forward goes Ninoo, and so on, until the distance is so little the Seal is actually struck down by the paws of the Bear. This most remarkable fact is verified by numerous observers. Capt. Hall had a native, named Koojesse, who, like some others of his kind, had learned to imitate this method of hunting from the White Bear.

Hall witnessed this "talk" with a Seal. Koojesse laid upon the ice, and crawled as near as was prudent towards the Seal. As they recognized each other, Koo' began pawing the ice with his right hand and foot, while he uttered his "Seal talk." At this, the Seal rose and shook his "flippers" both fore and aft, seemingly in imitation of Koo', and rolled over in apparent delight. Now it dropped its head, evidently in "cat-nap." Then Koojesse hitched along still nearer, and so on, the intervals of sleep or repose, and alertness, being quite regular, until the creature was within striking distance of the spear.

In winter, the Seal is driven to considerable ingenuity to provide its home comforts; especially is the female so situated. In addition to the usual hole kept open for its necessary breathing place, the female constructs a dome under the snow, just over the hole; this is merely an excavation around the external surface of the opening in the ice, the snow at that time supposed to be of considerable depth. The snow is pulled down into the hole and cast into the water. A shelf is left around the borders of the air-hole, on which the young are born. Here they are nursed and tended until able to dive into the cold, dark seas to search for their own substance. The *igloo*, as this Seal retreat is called by the natives, is quite secure from intrusion, unless the snow proves too light in quantity; the Bears and other Arctic *Carnivora* then succeed in preying upon the young. The Eskimos Dogs are often very successful in this hunting, or, rather, there are some of their Dogs that prove especially expert in it, and those animals are prized very highly, and are carefully trained to make the most of it; for the Dogs will not hunt for their own prey.

Seals are, as a group, very much alike in their diet, living on the same kinds of food; the most prominent are various species of *Crustacea*, which swarm in the northern seas. They are generally harmless, and susceptible of much cultivation. The common Phoca vitulina is often tamed, and proves an interesting and intelligent pet. The Bladder-nose, or Crested Seal, is an exception; it is reputed to be very combative. When approached, he inflates his crest and gives battle at once, not deigning to retire, and, indeed, often giving chase to his human enemy.

The anatomy of the Seal is peculiar in some respects. While in carnivorous animals generally the intestine is very short, in the Seal it is exceedingly extended, in some instances measuring fifty and fifty-six feet in length. There was at one time a notion held by physiologists that the Seal's habit of remaining beneath the water for so long a time, as it is known to do, was owing to structural differences in the heart and liver, &c. The *foramen ovale* of the heart was found in a few cases to be open, and other structural conditions were commented on with reference to this habit. It is now thought, by later observers, that the cause is entirely physiological, and not structural; this is hinted at in the example of several girls, who have exhibited their powers of subaqueous endurance in public. In one instance, the individual remained immersed fully three minutes, and a sister of the same person has practiced the performance in the New York Aquarium, remaining below the surface over two minutes at one time. There is, then, no special structure for this purpose, but an adaptability, so to speak. The Seal is said to learn gradually to swim and to remain immersed. The Seal has an enormous quantity of blood, which must be taken into account in this matter. In the Narwhal and other Whales there is a very large plexus, or network of blood-vessels, about the vertebral column; this would seem to point to the explanation of their endurance under water. Seals are said to remain some twenty-five minutes immersed, but authors doubt it; five to eight is the ordinary time observed in the case of the common species. It is interesting to compare the skeleton of the Seal with those of other Mammals, especially through the various grades down to the Whale, where the hind limbs are entirely wanting. See Plate 34, fig. 114, vol. i.

The Seal Fishery.

The commercial importance of the Seal fishery is very considerable to several of the great powers among nations. The number of Seals taken yearly by the British and continental ships (principally Dutch, Norse and German), in the Greenland seas, average about 200,000. It is estimated that from eighty to one hundred Seals yield about a tun of oil; this oil sells for $150 per tun. The skins are valued at a dollar and a quarter each; this, added to the preceding, exhibits an amount of nearly $300 as the value of between eighty and one hundred Seals. It is thought that the Seal fishery must at no distant day materially decrease, and eventually come to a serious interruption. It is well known that before the introduction of mineral or vegetable oils, the Whale fisheries were quite at a standstill; and that now the various cetaceans are notably increased in numbers. The south seas once produced an enormous number of Seals, many more than the north, and are now quite stripped of them.

Fossil Extinct Pinnipedia.

The secondary formations of New Jersey, in which the green sand occurs, were supposed at one time to have furnished remains of a species of Whale and the tooth of a Seal. Authors differ in their estimate of the value of the determination in the latter case. Mr. Samuel R. Wetherill discovered the tooth in the green sand, about a mile and a half south-east of Burlington, N. J., associated with numerous fossil shells and Ammonites. This interesting relic excited a great deal of interest at the time, and was examined by many scientific men. It has since been mislaid, and doubts have been expressed regarding its nature. It was referred to a living genus, which circumstance elicited some criticism, as no genus of Mammals has lived through so many cycles. This tooth was described by Dr. Leidy, in *Proc. Acad. Nat. Sci., Phila.*, 1853, under the name of the existing genus, Stenorhynchus vetus, from a drawing by Mr. Conrad. In

this genus there is a striking resemblance of the teeth to those of a Shark; it has, therefore, been suggested that this may be nothing more than a worn specimen of the latter, such being found in the locality from whence the Wetherill specimen came. The next more ancient deposit in which Seals have been found is the Miocene. Six or eight species have been found in this and Pliocene deposits. Dr. Mantell met with considerable numbers of the bones and teeth of two species of Seals in the superficial deposits of birds' bones, which lie in immense beds on the northern and middle islands of the New Zealand group. These are supposed to be those of Stenorhynchus leptonyx and Phoca leonina—species now living on those islands. Similar deposits, made up of the remains of the common Seal (Phoca vitulina) are seen on the coast of Great Britain. In the upper Miocene of France extinct fossil forms occur, resembling the Otaria of the Antarctic regions; and in the Pliocene of Montpelier, of the same, is an extinct Seal, named Pristophoca occitana. Remains of Pinnipeds are also found in Algeria, embedded in Post Tertiary deposits.

FAMILY—PHOCIDÆ.

Phoca is from the Greek—a Sea-calf, or Seal—used as such by Pliny, and often by Greek writers in song and story. The term is here used to designate an important group of Seals, which have the muffle hairy on the edge and between the nostrils. The ears have only a small aperture and no conch. The arms and legs are very short, and the wrist equally so. The toes are sub-equal, arched and exserted. The hind-feet are large and fan-shaped; the inner and outer toes large and long, the three middle ones shorter. The palms and soles are hairy. The claws are distinct and sharp. The cranium has no post-orbital process, or is obsolescent. The alisphenoid canal is absent. The mastoid processes are produced largely, seeming to form a portion of the auditory bullæ. The scapula is extended upwards and backwards towards the posterior superior angle. There is no scrotum, the testicles being enclosed in the body.

TRIBE—PHOCINA.

Dr. J. E. Gray, whose system we follow here (*Supplement to the Catalogue of the British Museum, Seals and Whales*, 1871), arranges the Seals in several tribes, the present including individuals with skull tapering in front, nose-hole moderate in size, the molars, excepting the first, with two roots. This tribe is confined to the North-Atlantic and Arctic seas.

CALLOCEPHALUS.

This genus includes those having a rather narrow muzzle, waved whiskers, fingers gradually shortened, palate angularly notched behind, sub-cylindrical hairs, thin under-fur, and hairy hind-toes between the webs.

THE COMMON SEAL (*Callocephalus vitulinus*)—Plate 12, fig. 40—of our northern and eastern shores, is the common Seal of England, and ranges over the whole northern shores of Europe. It is the Phoca vitulina of Linn., as well as P. communis; P. canina of Pallas; and P. variegata, linnei and littorea of others. English sailors call it Sea-dog, Sea-calf, Sea-cat. Scotch fishermen name it Selkie, Selach and Tang-fish. In West Scotland it is Rawn. The Swedes term it Spräklig Skäl. In other parts of Scandinavia it is Wilkare Skäl, Kubbsael and the Spotted Seal (den Spattede Säl). In Norse it is Stenkobbe; Finnish, Hylje; German, See-hund (Sea-hound); French, Veau marin and Phoque. The Danes in Greenland name it Spragled Sael-hund. The Eskimos in some parts call it Tupelo, on being shown a picture of it.

South of Hudson's Bay this species is not numerous on our shores, only single individuals being seen occasionally, either swimming near the entrance of some harbor or mouth of river, or, as at Nahant, living in very small colonies on the rocks some distance off shore. We knew of such a colony that occupied the ledge known as Lobster Rocks, at the entrance of Lynn Harbor. When the water was smooth, the round heads of these creatures could be discerned shining with reflected light. The Seal has a large brain, and is, consequently, very intelligent; its face beams with good-nature and intelligence; its eye is very attractive and gentle in expression. Several are kept in the New York Aquarium, where they amuse the visitors by numerous manipulations, which they have been taught to perform. They are very easily tamed, and seem always to have a strong attachment for their master. The voice of the Seal is a bark, much like that of a Dog. When irritated, it makes a noise like the snarling of an angry Cat, showing its teeth. Some species are said to utter the syllable *pa* repeatedly.

This species probably affords the Greenlander and Eskimos their most useful article of domestic comfort and also of trade. The Seal skin is applied to innumerable uses, and the flesh is all-important as an article of diet. The native huts are lighted by the oil; the blood, mixed with other substances, forms an edible soup; and the sinews are put to endless uses in the outfit of the fisherman and hunter. Even the membranes are dried and stretched over the apertures of the huts, to serve as windows in lieu of glass, being sufficiently translucent to admit all light for practical purposes. Seal hunting on a great scale is seen on the coast of North America; sixty ships of one hundred to one hundred and fifty or two hundred tons each are engaged in the business. The oil is the most valuable portion. Each Seal supplies about a half a barrel of oil.

In size this species is about four feet in length, some reaching nearly five feet. De Kay, who calls it Phoca concolor, gives, as its characteristics, the color as uniform dark slaty-gray; the young entirely light yellow. It breeds in Autumn, bringing forth commonly two at birth. A certain reef in New York Harbor—Robin's Reef—is named from the fact that numbers of Seals formerly resorted there; the term robin or *robyn* being the name in Dutch for Seal. Even now

they are occasionally seen, particularly at Execution Rocks, in Long Island Sound. Some are seen in Passaic River, N. J., every year, and are not unfrequently taken in nets. Mention is made by Dr. De Kay of one being exhibited in New York, in 1824, which was taken in a seine in the Chesapeake Bay, near Elkton, Maryland.

An interesting circumstance is that a Seal, closely like the present species, named P. caspica, is now living in the Caspian Sea, and another, allied to P. fœtida, in Lake Baikal. The water of the latter is wholly fresh, and the former does not contain one fourth of the saline contents of sea-water. These species are regarded by some authors as undoubtedly identical with the forms they resemble, and the inference is strong that those lakes have at one time been portions of the Arctic Sea, the land now intervening having been upraised.

The specific name, vitulina, is derived from the Latin, meaning Calf-like; probably its voice suggests the idea, as the young utters a plaintive cry when deprived of its mother.

RINGED SEAL (*Callocephalus hispidus*).—This is found in the North Sea. Fred. Cuvier gives the following description: "Grinders more simple than those of C. vitulina; skull more depressed; intermaxillaries advanced between the maxilla and the nasal for one third of their length; frontal and palatines not united in the orbits; palate angular behind."

Another variety, called C. fœtidus, and also the Ringed Seal, is described as having the back blackish, or on its side large oval, whitish, thin rings; the circle round the eyes of one color; the hairs of the beard thin and brown; the grinders rather far apart; fur short and crisp, recurved at tip; lower jaw dilated and inflexed beneath in front. The young a greenish-black; eye unlike adult; beneath, paler. This is Pagomys fœtidus of Muller; P. fœtida of same; P. bothnica, Gmelin; P. fasciata, Shaw; P. annellata, Nilsson; P. discolor, Gray; and P. frederica of Lesson. Its popular names are Ringlad Skāl, Morunge, Hringanor, Kuma, Nerpa, of Russians; Neitsiah of Greenlanders and Danes; Hoe-rat of Northern English and Scotch. It is the smallest of the Greenland Seals, and is considered of little consequence commercially. The specific name, fœtidus, is derived from the fact that the old males emit a most disgusting odor. Homer refers to this as follows:

> "Web-footed Seals forsake the stormy swell,
> And sleep in herds, exhaling nauseous smell."

This species seems to be confined to high latitudes in Spitzbergen Sea. In North Greenland they are captured by the natives for food and other uses; and some are found in Southern Greenland, being quite numerous about August.

In the arrangement of Gray, the Caspian Seal (*C. caspicus*) comes next; it is supposed to be a waif of the common C. vitulina.

Two species are enumerated after the above—the Norway Seal (*C. dimidiatus*), and Largha Seal (*C. largha*)—the latter from the North Pacific.

PAGOPHILUS.

This genus is represented by individuals having the palate truncated behind; fingers gradually shorter; muzzle rather produced; hair dry, flat, close-pressed, without any under fur; web between the hind-toes, baldish. The lower jaw is dilated and inflexed beneath in front, so as to close in the front part of the gullet. The grinders are rather distinct. They inhabit the Northern Ocean.

HARP SEAL (*Pagophilus grœnlandicus*).—This is Phoca oceanica of Lepech; C. oceanicus, Lesson; P. semilunaris, Bodd; P. dorsata, Pallas; P. mülleri, Lesson; P. desmarestii and P. pilayi, of same; P. lagura of F. Cuv.; and P. albicauda of Desmarest. The popular names are: Saddle-back of English sailors; White-coats and Bed Lampiers of Newfoundland sealers; Svartsiden of Danes; Atka of Greenlanders. The dark markings on its sides and back give rise to some of the names above mentioned. The habits of this Seal are much the same as those of other species. It is regarded by the sealers as rather a stupid creature, and easily captured. Its food consists of crustaceans and small fishes. It has a wide range, being found at different seasons of the year in all parts of the Arctic Seas. Stragglers find their way into the temperate climate, and this species is now recognized as a member of the Fauna of all the northern shores of Europe and America. To the Greenlander, these Seals prove of vast importance for their hides, oil and flesh. One full-grown animal will weigh 230 pounds, the skin and blubber being 100 pounds.

THE BANDED SEAL (*Pagophilus equestris*).—This species is recorded under the generic title Pagophilus, but with a ? It is the Phoca equestris of Pallas; P. fasciata of Shaw; and P. annellata of Radde. Gill arranges it in the genus Histriophoca, under the same specific name as is here adopted. The Banded Seal is not well known; its distribution is said to extend eastward to Amoor Land. It is seen on the coast of Alaska, bordering on Behring Sea, and is an occasional visitor at the Aleutian Islands. Gill remarks: "The species is remarkable for color, as well as structural peculiarities. The male is at once recognizable by the color, and this may be said to be a chocolate-brown, except (1) a band of whitish-yellow, bent forward towards the crown around the neck; (2), an oval ring of the same color on each side, encircling the fore-feet, and passing in front just before them; and (3) another band, also bent forward above, behind the middle of the trunk. There is considerable variation in the extent of these bands, and sometimes the pubibrachial rings are more or less confluent with the posterior band. The females are simply whitish-yellow, or have very indistinct traces of the posterior band." The Russian traders used formerly to procure the skins of these Seals for ornamental purposes, visiting Cape Romanzoff to get them. The species measures from 6 to 8 feet in length.

Another species, called Pagophilus ochotensis, is mentioned by Gray as living in the North Pacific; it is Phoca ochotensis of Pallas.

HALICYON.

Under this head Gray places two species.

RICHARD'S SEAL (*Halicyon richardi*)—inhabits the North Pacific and Columbia River.

PEALE'S SEAL (*Halicyon pealii*).—This is the Halichærus antarcticus of Peale, *Wilkes' U. S. Exploring Expedition.* "Gill calls this a typical species of Phoca, and adds that it appears to be identical with those that occur along the California and Oregon coasts. So there must be some error as to the assigned habitat in the Antarctic Seas, and proposes the name Phoca pealii."

PHOCA.—*Gray.*

THE BEARDED SEAL (*Phoca barbata*) is the Phoca lanica of one author; Callocephalus barbatus of F. Cuvier; Phoca leporina of Lepech (?); and Callocephalus leporinus of F. Cuvier. Its popular names are Leporine Seal and Great Seal. It is distinguished by having larger and longer moustaches, and in being one of the largest of the order. Among the Eskimos it is prized particularly for the very serviceable hides from which, on account of the length, they procure fishing-lines and harpoon-lines. The blubber is more delicate in taste than any other, and is prized accordingly. This Seal is said to be occasionally seen off the northern coast of Scotland. It is considered solitary in habit, and frequents the most distant and undisturbed places. It is not so watchful and lively as the Common Seal, nor is it so easily alarmed. Its length is about 14 feet. Its color is a deep brownish-black; in the younger state, a light greenish-blue. The body is full or ventricose; the hair very short, rigid; the tail very short.

THE WHITE-CHEEKED SEAL (*Phoca naurica*).—This species is recorded by Gray as a synonym of Phoca barbata of Temminck, in *Fauna Japanica*; and P. naurica and P. albigena of Pallas. It inhabits the North Pacific and the Japan Coast.

TRIBE II—HALICHŒRINA.

In this group the muzzle is broad and rounded. The skull is higher in front; the nose-hole very large; the grinders conical; the two hinder of the upper, and the hinder one of the lower jaw, double-rooted.

THE GRAY SEAL (*Halichœrus gryphus*).—This is a well-known species on the coast of Sweden, and is occasionally seen in the waters off Greenland, in Disco Bay and elsewhere. It is various-named by authors—as, griseus by Nilsson; Phoca halichœrus by Thienemann; P. thienemanni by Lesson (in young state); and P. scopulicola by Thienemann (young). Its popular names are Graskäl of the Scandinavians; Tapvaist of the Scotch; and Häaf-fish of the northern Scotch. The latter name is used by Sir Walter Scott in the "Pirate." The Icelanders call it Utselur. The resemblance of this species, in many respects, to the Walrus, has given rise to discussion with reference to its true place. A character which closely approaches the Walrus is seen in the disproportionate size of the brain, as compared with that of the Common Seal; its remarkably small brain seems to be accompanied by a corresponding degree of intelligence—(as the creature has not been successfully tamed or domesticated)—failing entirely to exhibit the bright, "knowing" aspect of the other members of the order. The size of the brain of this species, which measured eight feet in length, did not exceed that of a Common Seal (*P. vitulina*), which is less than four feet in length.

TRIBE III—MONACHINA.

This tribe is placed under a section by Gray, which has four cutting-teeth above and four or two below. In this particular tribe the cutting-teeth are $\frac{4}{4}$, the upper ones transversely notched. The palatine bones are not produced beyond the inner margin of the orbits. They inhabit the Mediterranean Sea and the North Atlantic.

The typical genus, Monachus, is an inhabitant of the Mediterranean, and includes one species—the MONK SEAL (*M. albiventer.*)

TRIBE IV—STENORHYNCHINA.

The cutting-teeth are $\frac{4}{4}$, conical and acute. The hinder-feet are nearly clawless.

STENORHYNCHUS.—*Gray.*

This genus is represented by one species, an inhabitant of the Antarctic Ocean.

SEA LEOPARD (*Stenorhynchus leptonyx*).—The nostrils of this species open like those of the Whales. The stomach, when examined, was found to contain sea-weeds and a large quantity of small parasitical worms. "The species appears to extend from the Antarctic to the New Zealand Seas, the New South Wales and Falkland Islands."—*Gray.*

LOBODON.—*Gray.*

This genus, and several following, has the three front upper and first front lower grinders single-rooted; the rest two-rooted. The skull is elongate, and the muzzle similarly produced. The molar teeth are rather compressed, with large lobes in front, and three lobes behind the large central one. The head is lengthened considerably. The ear has no conch externally. The muzzle is broad; nostrils ovate, and hairy to the edges. The whiskers are stiff; the orbits large, or moderately so; the posterior portion of the temporal bone very convex, nearly hemispherical. The cutting-teeth are $\frac{4}{4}$; Canines, $\frac{1}{1}$–$\frac{1}{1}$; Molars, $\frac{5}{5}$–$\frac{5}{5}$. The fur is close-set, rigid, with no under fur.

THE CRAB-EATING SEAL (*Lobodon carcinophoca*).—In this species the head, back, hind-feet and upper part of tail, pale olive; the fore-feet, sides of face, body, and tail beneath, yellowish-white; the hinder parts of the sides of the body, and base of hind-fin, yellow spotted, the spots unequal and often con-

fluent. The whiskers are white, the upper ones dusky and smaller. The expedition of the Erebus and Terror procured this Seal, and the British Museum possesses the specimen. Its habitat is in the Antarctic Seas.

LEPTONYX.—*Gray.*

In this genus the skull is broad and depressed behind; the muzzle is short and broad; the grinders are somewhat compressed, with a small sub-central conical tubercle, and a very small posterior one; the lower jaw narrow behind, without any hinder angle. The fore-feet are clawless. The head is flattened, the profile presenting a form like cupid's bow; muffle hairy between the nostrils, the latter ovate in form. The whiskers are flattened, and somewhat waved. There is no exterior conch to the ear. The skull resembles Cuvier's figure of Phoca bicolor; the nose rather short, broad, and high above; orbits rather large; petrous portion of the temporal bone convex and hemispherical. The cutting-teeth are $\frac{4}{4}$, conical, somewhat recurved; those of the upper jaw largest, the middle in each jaw smaller, the outer upper much larger. The canines are $\frac{1}{1}$–$\frac{1}{1}$, large, conical, curved and compressed, the upper the largest. The grinders are $\frac{5}{5}$–$\frac{5}{5}$, prominent. The lower jaw is slender, with a short symphysis in front, and narrow, without any angle at the hinder part of the lower edge. The fore-feet are small, elongate, triangular, hairy above and below; the hind-feet are moderate in length, the two marginal toes the largest, rounded at the end; the claws are small, the two middle ones largest. The fur is short, with no under fur.

FALSE SEA LEOPARD (*Leptonyx weddellii*).—The Antarctic Expeditions—notably that of the Erebus and Terror—brought specimens of this Seal. At Patagonia some were observed. It is easily distinguished from the Stenorhynchus by the shortness of the wrist and the triangular form of its fore-feet. This is intermediate between Stenorhynchus and Ommatophoca.

OMMATOPHOCA.—*Gray.*

The skull in this genus is broad, and depressed behind. The muzzle is broad, very short. The orbits are large. The grinders are small, compressed, with a central incurved lobe, and a small lobe on each side of it. The canine-teeth of the male are four to five inches long. The fore-feet are very slightly clawed. The ears are small, no external conch being visible. The muffle is hairy between and to the edge of the nostrils; the latter are oval. The whiskers are tapering, conical. The cutting-teeth are $\frac{4}{4}$, small and conical. The tail is short, and conical in shape. Fur close-set and rigid.

ROSS'S LARGE-EYED SEAL (*Ommatophoca rossii*).—This is described as of a greenish-yellow in color of fur, with close, oblique yellow stripes on the side, and pale beneath. It is figured in the *Zoölogy of the Erebus and Terror*. Its habitat is in the Antarctic Seas.

TRIBE V—CYSTOPHORINA.

In this group the cutting-teeth are $\frac{4}{4}$. The grinders have large, swollen roots, and a small, compressed, simple-plaited crown. The muffle of the male has a dilatable hairy appendage.

MORUNGA.—*Gray.*

The genus Morunga is characterized by having the muzzle broad and truncated in front, and the forehead convex. The front claws are obsolete, the hinder ones distinctly formed. Whiskers are very long and large. It is said to have many characters in common with the Crested Seal of northern waters. Lord Byron mistook the male and female of this species for mother and young, as there is great discrepancy in size, the male being eighteen feet and the female about ten feet in length.

THE SEA ELEPHANT (*Morunga elephantina*)—Fig. 39, vol. i., p. 127.—This is a rival of the Walrus in singularity and immensity. It is curious, as simulating in the sea the greatest beast of the field and forest. There are numerous synonyms, by as many authors. One of them is M. patagonica, which indicates that the creature has been seen near that locality. We, therefore, gladly introduce it in our *History of the American Fauna*, as it is a wonderful object, and one about which most astonishing tales are told. There is nothing more surprising than the record of its length and bulk. Some author gives the length of an individual as thirty feet, and a circumference of eighteen feet. It is said to live a good deal out of water, wandering among the marshy grounds. Now, this is extraordinary, too, when we consider what an enormous bulk there is to be dragged or jerked along by aid of its insignificant feet or "flippers." It is said to emigrate, moving southward as the summer comes on, and, when the winter weather sets in, returning to its haunts in the more northern regions. The first emigration is in June, when the females give birth to their young. A curious story is told of the males at this time forming a cordon between the females and the sea, to prevent them from deserting the young. This story is not vouched for. The males fight desperately. They are thought to be polygamous, each male having a herd of females in his charge. The hunters take advantage of the fact that females will continue to herd around the male even when closely pressed; the latter is, therefore, not molested, while the females are shot down in numbers. Should the male be killed, the females would disperse at once. The Sea Elephant is considered as rather sluggish and inactive, and is not so formidable an antagonist as the Walrus, notwithstanding its great bulk and strength. Its teeth are most formidable in aspect, though the molars are small—the latter have a curious mushroom-like apex. The canines are large. The peculiar proboscis-like appendage of the nose, seen only in the adult males, is not very conspicuous when the creature is at rest; but, when excited, it blows into it, causing such an inflation that the re-

semblance to the trunk of the Elephant is quite apparent. Like other Seals, it is easily tamed. The young are nearly as large as the Common Seal of our waters at birth, a circumstance which gives an idea of the immense bulk of this creature. Two cubs are generally produced, the period of gestation being about nine or ten months. The full-grown male is said to yield seventy gallons of oil. One of the Falklands is called Elephant Island, from the fact that enormous numbers of these creatures frequented it. Mr. Sclater informs us, however, that when Lecomte visited the island they had deserted it. They are yet met with in other localities.

CYSTOPHORA.

The nose in this genus, in the male, is provided with a compressed hood of considerable dimensions, extending to the back of the head; the muzzle is broad and hairy; the nostrils are large. The muzzle of the skull is broad, and narrowed on each side in front. The forehead is flat; the palatine bone broad and square. The hair is elongate and cylindrical; the whiskers flat and waved. The claws are five in number, distinct from the integument. The young is like that of the Harp Seal, but is distinguished by the hairiness of the muffle between the nostrils, and by the teeth not being lobed, but only plaited on the surface.

HOODED SEAL (*Cystophora cristata*)—Fig. 37, vol. i, p. 126—is another curious form belonging to this order, the hood in this case being the more striking feature, though the extreme size to which it attains invests it with more than ordinary interest. The head of the Crested Seal is very broad, and the muzzle is short. A cartilaginous crest rises abruptly over the head, six or seven inches in height, forming a sort of keel in the centre; this supports a sort of cowl or hood, which is a development of the septum of the nose, the nostrils opening on each side of it. This is not seen in the young and the females, and is only noticed when the male is enraged, being then inflated in a most grotesque manner. The uses of this crest are not understood; it is one of many such examples where the male is provided with some extraordinary appendage, which seems to be connected some way with sexual functions. The males are extremely pugnacious, particularly during the mating season. The color of this species is a dark blue-black on the back, fading to a yellowish-white on the under portions of the body. Large gray spots are spread irregularly over the body, and in the centre of each is a black spot. The head, tail and feet are black. In the young animal the colors are not so dark, being a slate-gray on the back and silvery-white beneath.

The Crested Seal is found in South Greenland, and is occasionally seen on the opposite shores of the main-land. It is quite common in Davis' Straits from September to March. The natives here give it the name of Neitsersoak. A small specimen of the Crested Seal, which the sailors called Bladder-nose, is kept alive at the New York Aquarium. No attempt has been made to tame it; it is, therefore, wild and shy.

WEST INDIAN HOODED SEAL (*Cystophora antillarum*).—This is recorded by Gray as having a broad face; the outer and upper cutting-teeth and canines broad and strongly keeled on each side, and longitudinally plaited within. The fur is gray-brown in color; the lips, and beneath, yellow. Dr. Pickering, in the *Report of U. S. Exploring Expedition to the Antarctic Seas*, saw one in mid-ocean 135 miles distant from land; it was concealed under water at times, and appeared to swim entirely by its pectoral fins.

FAMILY—TRICHECHIDÆ.

The muzzle in this family is broad, truncate, and swollen above. The ears have no conch. The eyes are very prominent. The skull has no post-orbital processes; the mastoid processes are strong and prominent, the surface being continuous with the auditory bullæ. A distinct alisphenoid canal is present. The cutting-teeth are $\frac{1}{2}$ in the young, and $\frac{2}{2}$ in the adult; the grinders all with single roots. The scapula has the hinder margin nearly straight, with the spine a short distance from and nearly parallel to it. The anterior and inferior feet are equal in size, the former destitute of claws; the fingers decreasing in a curved line; the hind-feet with five toes, all provided with claws; the palms and soles are hairy in the young. Tail is rudimentary. The locomotion is produced by the action of the abdominal muscles while the feet are placed flatwise on the ground, the hind-feet being brought forward, with the posterior third of the body curved under.

TRICHECHUS.

The Walrus is the one only form in this genus. Its generic characters are largely embraced in the preceding family description. The muffle, palm and soles are callous, with the hair more or less worn off in the adult. The skin is covered with small ovate scales. The nose has very rigid, white, compressed bristles, rounded at the end. The fore-feet are small, the front claw rudimentary; the hind-feet rather large, the first and fifth toes elongated, with a distinct flap and rudimentary claw.

THE MORSE; WALRUS (*Trichechus rosmarus*)—Plate 13, fig. 42.—This is the most remarkable and most formidable of the members of this order. It is found in vast herds, which frequent the regions of ice in both polar seas. As many as seven thousand have been seen in a herd. Curious tales are told of their habits. The Walrus is sluggish on land, and, consequently, is quite willing to rest wherever he may drop after crawling up from a hole in the ice; others coming up give him a push, and so the curious movement goes on, until hundreds often are collected. As may be imagined, this great creature is clumsy and unwieldy on land. It attains a great size—a full-grown male measured fifteen feet in length, and authors mention even greater bulk. The Walrus has been tamed, and it is said to be quite as

docile and intelligent as the Seals. It produces one usually at a birth. Winter is the usual time for the appearance of the young. The mother nurses it on shore, and in the water carries it under the "fore-flippers." The term Walrus signifies, literally, "Whale-horse," and the specific name is from the Latinized Norwegian, Rosmar, "Sea-horse." It is thought that the Walrus feeds mostly on vegetable matter procured at the sea-bottom, and that one of the uses of the great tusks is to uproot its food, which consists of certain parts of the vast growths of algæ. The flesh is highly prized by the voyagers, as well as by the native population of the Arctic regions. The dentition is curious, and a portion of it—the tusks—quite remarkable. These are sometimes two feet in length, the girth measuring nearly seven inches, and the weight ten pounds each. Ordinarily the tusks are about one foot in length. The ivory is very fine in quality, and commands a large price. The immense size of the roots of the tusks necessarily requires a corresponding breadth of snout to receive them and give strength to weapons so formidable; this results in a peculiar aspect of the face, which is rather ferocious and forbidding. The other teeth are very small, comparatively. While young there are six incisors in each jaw, two canines, ten molars in upper jaw and eight in lower. When the animal has reached its full growth, the incisors all fall out. The economy of this phenomenon is not apparent. The Walrus proves a most valuable prize to the native population. Its skin, teeth and oil are valued highly with us, while with the natives its whole carcass furnishes almost every article required in their domestic life. In close quarters it proves a formidable foe; and being very tenacious of life, it fights with intense fury, even when severely wounded. The enormous tusks prove terribly destructive, especially when the creature is approached by a boat, when the latter affords an object upon which to spend his vengeance and fury. Though strictly an Arctic animal, yet stragglers have been known to visit the coast of Scotland. The young animal is black throughout, the adult a pale brown. The Walrus is a northern form, inhabiting more especially the North Pacific.

FAMILY—OTARIADÆ.

EARED SEALS.

The nose in this family is simple; the muffle rather large, callous above and between the nostrils; ears with a cylindrical, external conch. The arms and legs are rather elongate. The fore and hind-feet are fringed. The fore-feet are fin-like, with a scalloped naked membrane. The hind-feet are clawless, and palms and soles of both are bald. The toes are nearly of equal length, the outer one on each side being rather the strongest; the three middle toes have claws. The fur has more or less of under fur, distinct and shorter. The alisphenoid canal is present, as is also a post-orbital process. The cutting-teeth are $\frac{6}{4}$, the upper ones often bifid. The canines are conical. The grinders are $\frac{5}{5}$ or $\frac{6}{5}$.

The Eared Seals form quite a natural group or family distinct from the Earless Seals, the *Phocidæ*; they also exhibit features, many shades advanced, as mammals. They have limbs that serve them somewhat more like those of the typical quadrupeds; they progress on land by aid of these limbs, the body being at the time raised from the ground. The scrotum and genital organs are external, as in the Dog. They do not swallow under water, nor do they masticate there; and they do not drink as the Earless Seals do at times. The pupils of the eyes contract and dilate enormously. The skulls of these animals change very materially during their growth, insomuch as to render it a matter of much difficulty to determine species, without a large experience and a very full series of specimens. Eared Seals are characterized particularly by the under fur, which lies between the roots of the longer and more rigid hairs; hence, the more familiar term of the sealer—the *Fur Seal*. Much difference is noticed in the quantity and fineness of their under fur, which varies according to the species or country. Those having inferior fur are called Hair Seals, and are collected generally for their oil, the skins not being much prized. It is said that the Fur Seal skins are much in request in China. In Gray's *Supplement to Cat. Seals and Whales*, 1871, the only species of Eared Seal, or Fur Seal, that had been observed in captivity was the Otaria leonina, or Sea Bear. Since then several others have been kept successfully, and much information is likely to be recorded concerning their habits. Among facts recently noted by seafaring observers, those furnished by Captain Musgrave are interesting. He says: "Their habits are much unlike those of the Earless Seals. The young are brought forth far inland, and they are taught to swim very gradually; at first the young do not take readily to the water, their dams devoting considerable time to this duty."

TRIBE I—OTARIINA.

OTARIA.

In this genus the grinders are $\frac{6}{5}$. In the adult skulls the fourth upper grinder is under the front edge of the orbit, and the sixth and last in a line with the back edge of the zygomatic arch. The hinder edge of the palate is rather in front, on the line of the condyles.

THE SEA LION (*Otaria jubata*)—Fig. 38, vol. i, p. 127—is a most ferocious-looking creature, having the savage aspect of the other large species, and additional features which add materially to its formidable appearance. It is very large, measuring fifteen feet in length, and weighing some sixteen hundred pounds. The color of the male is a reddish-brown, which is paler in the older ones. Upon the neck and shoulders is a heavy mass of stiff, curly, crisp hair, bearing some resemblance to the mane of the Lion. The female has no mane. The fur is a chestnut-brown. In the fall of the year Sea Lions are seen in great numbers on Behring's Island, where they rear their young. The male is said to

take charge of only three or four females, instead of a whole herd, as is the habit of some Seals. The Sea Lion is reputed to be naturally peaceable, permitting the approach of man with indifference. It is easily taken by the hunters, and great numbers of them are slain—the natives securing them by means of poisoned arrows, as well as by the harpoon. The blatant voice of these creatures is something fearful.

TRIBE II—CALLORHININA.

The grinders in this tribe are $\frac{6}{5}$-$\frac{6}{5}$. The skull is oblong; the face broad, shorter than the orbits, and the forehead arched.

CALLORHINUS.

This, the typical genus, is characterized by an elongate skull, which has the forehead rounded in front of the orbits, and the same rather swollen. The palate is concave, as wide in front as at the end of the tooth line, and rather narrowed behind. The sixth upper molar is just behind the hinder edge of the zygomatic arch. The fifth and sixth upper and the fifth lower molar have two diverging roots. The fore-flippers are small and narrow; the flap of toes very long.

NORTHERN SEA BEAR (*Callorhinus ursinus*)—Plate 13, fig. 41.—This is Phoca ursinus of Linnæus; Otaria (Callorhinus) ursina of Peters, 1866; Otaria stelleri of Lesson and Muller; C. ursinus of Allen; Arctocephalus ursinus of Gill, 1866; A. monteriensis and Californianus of Gray, 1859 (young ones). Gray records this Seal as inhabiting the seas of Kamtschatka. Scammon gives the Fur Seals a wide geographical range, extending nearly to the highest navigable latitudes in both northern and southern hemispheres. He observed this species in Behring Sea and on the coast of California. In the latter locality he found them breeding from May to August, and on the coast of Patagonia from October to March. The habits of the Fur Seal, according to Scammon, differ considerably from those of the Hair Seals. Their geographical range is very extended; they bask in a tropical sun, or endure with apparently equal comfort the rigors of the icy regions of the poles. On the coast of Chili their numbers were so great, in 1798, that the American ship Betsey procured a full cargo of skins. It was estimated at the time that there were left on the island—which is not over twenty-five miles in circumference—at least 500,000 Seals. Subsequently there were taken but little short of a million skins. The Seal-fishery in this region was carried on almost exclusively under the American flag. On the Pacific Coast, from Gray's Harbor to Vancouver Island, the native Indians take a few Fur Seals. The latter make their appearance about March, and remain until midsummer; during this period the Indians devote their whole time to the sealing. The best locality for this is said to be Cape Classet. The islands of St. Paul and St. George, in Behring Sea, are favorite localities. That these Seals migrate is a well-known fact, but where they pass the winter is a puzzle to observers. They make their appearance at the proper season in spring, plump and fat; the females produce their young, and the countless herds remain along the shores, usually in selected localities, until the young are able to take to the sea. Observation proves that in some instances individuals return to the same rocks many years in succession. An old chief of the native tribes in Alaska witnessed the return of a Fur Seal seventeen years successively to the same rock. This Seal had lost one of his flippers, which rendered him very noticeable.

A Captain Bryant spent some time upon the island of St. Paul, and made some very intelligent observations of the habits of these creatures. About the first of April, when the snow is quite gone and the drift ice has mostly passed, a few old males are seen in the water about the island, and, after two or three days' reconnoissance, venture on shore and examine the rookeries, as they are called. After a few days, more begin to arrive, the first having departed to convey the information that all is right. The old males do not allow the young ones to come to their grounds, and they appropriate with considerable exactness a certain amount of space for themselves and harem, which consists of from ten to fifteen females. "Might is right," is their motto, and the old males determine their places by that code. The young males are kept at proper distance, herding by themselves at another portion of the shore. Captain Bryant gives some most extraordinary statements of the habits of the old males. He says: "As soon as a female reaches the shore, the nearest male goes down to meet her, meanwhile making a noise like a clucking of a hen to her chickens. He bows and coaxes her, and then, when he has gotten himself between her and the water, alters his tone, and growls harshly at her, and drives her to a place in his harem. The males select a time when their neighbor 'turk' is away from his home, and then steal his wife or wives; this they do by taking them in their mouths and lifting them over the heads of the others, carrying them as a Cat does her kittens." Captain Bryant vouches for these statements, as also for the fact that the old males do not eat for a long period, while they are in attendance upon the harem. He says: "The old males teach the young to swim on their return from feeding—the latter being rather reluctant at first to enter the water. By the last of October the Seals begin to leave the islands in small companies, the males going last, and by themselves."

The account given by Captain Scammon is so profuse in valuable facts which are not generally accessible, we take it as desirable to present more fully the matter relating to the capture of the Fur Seals, and their preparation for market. During the months of June and September the natives take the largest number for their skins. It will be seen how much more of a terrestrial animal the Eared Seal (*Otariadæ*) is than those of the *Phocidæ*, as the latter are too much like a fish to travel upon land

any considerable distance. The natives commence to drive herds of these creatures to some convenient place in shore, great care being taken not to heat them, as the fur is injured thereby. The old males are not desirable, and, as they are more stubborn and sullen, are easily left behind. The more valuable young or middle-aged are thus selected, and driven on to the killing ground, which is sometimes six miles away from the shore. This is done particularly to avoid disturbing the remaining Seals at the "rookery" by the smell of blood, and the havoc and noise thereby created. Arrived at the grounds, they are watched for a while until they are cooled, then the most desirable are dispatched by a sharp blow upon the nose. Besides the skin, each Seal yields a gallon and a half of oil. The linings of the throats are saved, and salted as an article of trade to other ports in the territory, being used by the natives to make waterproof cloaks or frocks, to wear in their canoes when hunting the Otter or fishing. The skins are salted and packed in square bins, where they lie about forty days; they are then taken out, the salt removed, and a small quantity of clean salt sprinkled upon them, when they are folded, flesh-side in, and packed for commerce. There are about twelve miles of sea coast on St. Paul's Island occupied by Fur Seals as breeding grounds, with an average width of fifteen rods. Allowing twenty Seals to the square rod, Captain Scammon computes the number of breeding Seals at the enormous figures 1,152,000. Deducting one tenth for males leaves 1,037,800 breeding females. The value of the skins at the ground, or that paid by the Russian Company to the natives, is ten cents per skin, the company finding bins and salt. Previous to 1866 the skins were worth $3.00 each. Soon after the transfer of the territory to the United States, which was about the time the skins became fashionable, they were valued at $7.00 each. In 1871 they were again at a low figure, bringing only $3.00 a-piece, owing to the over-stocked state of the market. At the time of the sale of the territory to the United States, it was estimated that the annual yield was 80,000 skins. The opinion of the men who have especial care of the Seals is that it has reached 100,000, and that the yearly killing of this number will in no way check their increase. In 1873 the number taken was 145,000, at the following places: St. George's Island, St. Paul's, and Behring Sea, 100,000, the remainder in Copper and Behring Islands, on the coast of California and Washington Territory, Robin Island, Okotsk Sea, South Shetland Islands and Cape Horn. The net value of the fishery is about $1,174,500 yearly.

Great care is required to determine clearly the identity of the species, when so much confusion exists in the nomenclature of these tribes. Peron, the distinguished Antarctic voyager and naturalist, is convinced that, "under the name of Sea Bear, there really exists more than twenty Seals which differ from each other in all their minute characteristic points." We are indebted to *Jardine's Nat. Lib., vol. xi., Seals*, for Steller's minute account of this Sea Bear, as well as for considerable other matter concerning it. Scarcely any order of Mammals is less known and less popularly described. The larger number of species are found noticed only in MSS. or the printed Transactions of Societies.

The Seals of this family are known to be more nearly amphibious and of higher organization than those of the *Phocidæ*. The present species is about the size of a very large Bear, and resembles no object more than that animal. Its extreme length is seven and a half feet. The teeth resemble those of the Sea Lion, only they are not more than one quarter the size. The apex of the tongue is bifurcated, the eyes very prominent and full, the iris black, and the pupil bright green; there are eyelids and brows, with a nictitating membrane to remove any foreign matter that may lodge in the eye. The limbs are so arranged that the creature may progress somewhat after the manner of land animals, although they are exceedingly uncouth and move very slowly. Steller says: "The skins of the young are much prized for clothing. When I was in Behring's Island, I prepared a garment for my use with my own hands, and will ever retain a grateful recollection of it. These animals are found in amazing numbers in the islands of the north-west coast of North America, and so crowd the shore they oblige the traveller to quit it and climb up the precipices." They are as regularly migratory as birds of passage.

TRIBE III—ARCTOCEPHALINA.

This tribe is characterized by having the molar teeth $\frac{6}{5}$–$\frac{6}{5}$, the face of the skull shelving in front, and the fifth and sixth molar teeth situated behind the front of the zygomatic arch. The name is derived from the Latin, meaning Bear-head, from the strong ursine appearance of these Seals.

PHOCARCTOS.

In this genus—also deriving its name from the same source as the above Bear Seal—the skull is elongate, and the forehead flat. The palate is concave and deep, with a thickened margin on each side in front, widest in the middle part of the tooth-line, and gradually narrowed behind the teeth; the internal nare is oblong, longer than broad, truncate in front, the front edge in a line with the orbital process of the zygomatic arch. The grinders have compressed roots; some of them have a very indistinct longitudinal groove on the side; the fifth upper grinder has two distinct roots. The ear bones are not prominent, and have a flat lower surface. The flap of the toes is moderate in size. Gray says, in connection with the above synopsis of the generic characters, "I have not seen an adult skull, but have described from those ten inches long, of which the bones are not knit." This is Otaria of Allen, in *Bul. Mus. Comp. Zoöl., Cambridge, Mass.*

THE SOUTHERN HAIR SEAL (*Phocarctos hookeri*) —This species has a brown-gray fur, slightly grizzled, nearly white beneath; hairs short, close-pressed, rather slender, flattened, black, with whitish tips;

the feet are reddish or black. The young are a pale yellow, varied with darker irregular patches; length 18 inches. The latter is in the British Museum. The Falkland Islands and Cape Horn are regarded as its principal localities.

ARCTOCEPHALUS.

This genus is established by F. Cuvier for several forms which come under the designation of FUR SEALS. The species have an under fur, which is nearly concealed by the coarser and stiff, bristle-like hair which covers the whole body. Commercially, these Seals are very important, their capture giving occupation to a large number of the inhabitants of the north-west coast. The characters are seen in the face of the skull being elongate, and the forehead flat; the palate is concave, particularly in front, with a thickened margin on each side near the teeth, and then narrowed behind; the internal nasal opening elongate, longer than broad, narrow and arched in front, edge in a line with the orbital process of the zygomatic arch, which is large and well developed. The flaps of the toes are moderately large. Gray examined an adult skull of this species, from Cape Horn, and states that the fifth hinder grinder has only very short rounded callous roots, which are slightly divided into two lobes, and the hinder sixth upper grinder seems to have a root of a similar character. In the skulls of the older (which are not adult, as they have the sutures between the bones still distinct) the fifth and sixth upper grinders have two distinct diverging roots.

A section is here instituted by Gray, which includes those forms that have the fifth and sixth upper molars with two roots (?); the sixth upper partly behind the hinder edge of the zygomatic arch. The following single species is recorded under this section, and its locality is Africa.

THE CAPE FUR SEAL (*Arctocephalus antarcticus*).—This is Phoca antarctica of *Fischer's Synopsis*, and Thunberg in *Mémoirs Acad., Petersburg;* A. schisthyperoës of Turner, in *Journal of Anatomy*, 1868; A. schistuperus of Günther, *Zoöl. Record*, 1868; A. antarcticus, Allen, *Bul. Mus. Comp. Zoöl., Cambridge, Mass., ii, p.* 45; A. delalandii, Gray, *Proc. Zoöl. Soc., Lond.*, 1859; and *Ann. and Mag. Nat. Hist.*, 1866; Phoca ursina of Cuvier, *Oss. fossil;* A. ursinus, F. Cuvier, *Mém. Mus., vol. xi.;* Otaria ursina, Nilsson; Halarctus delalandii, Gill; Otaria (Arctocephalus) pusilla, Peters, *Monatsb*, 1866; Petit Phoque, Buffon, *Hist. Naturelle;* and Phoca pusilla of Schreb.

The locality of this Seal is given as South Africa and the Cape of Good Hope. The descriptions are very meagre. Gray gives the following: (1) Adult male, with slight mane, called "large wig." Fur whitish, with a few intermixed black hairs; under fur short, reddish. (2) Adult, without mane, called by the dealers in furs, "middling." Fur reddish-white, grizzled, with scattered black hairs; under side of the body darker, reddish-brown; under fur short, reddish. (3) Young, about 18 inches long, called "black-pup," from Cape Good Hope. Fur black, polished, soft, smooth, without any gray tips, rather browner-black beneath; under fur brown, very sparse; hairs slender, polished, black, with very slender brown bases. The three specimens are in the British Museum.

Another section is characterized by Gray as having the fourth, fifth and sixth upper grinders with two distinct diverging roots; the fifth in a line with the hinder edge of the zygomatic arch. And this peculiar to America.

THE SOUTHERN FUR SEAL (*Arctocephalus nigrescens*).—This is described under the above name by Gray in *Zoöl. Erebus and Terror; Catalogue Seals and Whales* in *Ann. and Mag. Nat. Hist.*, 1866; as A. falklandicus in *Cat. Seals and Whales*, by Gray; by same as Euotaria nigrescens in *Annals and Mag. Nat. Hist.*, 1868; and as Otaria falklandica by Peters, *Monatsb*, 1866; A. falklandicus by Allen, *Bul. Mus. Comp. Zoöl. Camb., ii;* O. falklandica by Sclater in *Proc. Zoöl. Soc.*; and Otaria nigrescens of Morris, in same, 1869, p. 106.

The locality given for this species is Volunteer Rock, Falkland Islands, and the authority as Capt. Abbot. Gray says: "The two specimens in the British Museum agree in most particulars; but they differ considerably in the form of the hinder nostrils. One has the hinder nasal opening with a slightly arched, nearly truncated, front edge."

A third section, which includes the remaining species of Arctocephalus, has the fourth, fifth and sixth upper grinders with two diverging roots—the fifth upper grinder entirely behind the hinder edge of the zygomatic arch; the palate narrow. This group is found in Australia.

AUSTRALIAN FUR SEAL (*Arctocephalus cinereus*).—Peters calls this Otaria (Arctocephalus) cinerea, in *Monatsb*, 1866. Gerrard, in *Catalogue of Bones of British Museum*, has it A. nigrescens. In the *Catalogue of the Sydney Museum* it is called Otaria, or Black Seal. Allen, in *Bul. Mus. Comp. Zoöl. Camb.*, names it as A. cinereus. This species is black, with grayer beneath; the under fur is abundant, reddish-brown.

FORSTER'S FUR SEAL (*A. forsteri*).—This is described originally as Phoca ursina by J. R. Forster, who found it at Cloudy Bay, in New Zealand. Mr. Allen sees "no difference between this and A cinereus."

THE FUR SEAL OF COMMERCE (*A. falklandicus*).—This is the notable Fur Seal which supplies the rich furs of commerce. Pennant calls it the Falkland Seal. Shaw records it as Phoca falklandica, and Lesson as Otaria shawii, and the same author in a later work has it Otaria houvillii. Fischer in *Synopsis of Mammals* calls it Phoca houvillii. New Georgia, Falkland Islands, is the favorite habitat. It is a very distinct species, known from all others by the shortness, evenness, closeness and elasticity of the fur, and the length of the under fur. The fur is soft enough to wear without the removal of the longer hairs. In some kinds there are numerous long hairs, which are removed by shaving the skin until they fall out, the roots being severed by the process. This Seal is described as having a long and

slender shape, being much like a double cone, largest at the middle and tapering at the extremities. The head is broad and rather flat; the external ear black, narrow, pointed, and projecting backwards. The fore-paws are situated in the middle of the body, and have no nails. The hind flippers are rhomboidal in shape, and have a fleshy and membraneous expansion, which is terminated with five straps. There are nails to the toes, excepting the great one, those of the three middle being much the larger, and quite straight. There are five rows of whiskers of a brownish-black color, the hairs simple and tapering. In some specimens a dark marking under the eye is observed. The disproportion between the size of the male and female is quite surprising. The male measures nearly seven feet in length, and the female three and a half feet. This species is particularly polygamous; as many as twenty females often coming under the care of one male. In the early part of December the females land to produce their young, the male remaining with them during the period of gestation, the time being about twelve months. They seldom have more than one at birth. Great affection is displayed by them at this season, their young being tended with the greatest care. In about four weeks the young are able to take to the water. A singular fact, made apparent by close scientific observers, is that the young are *taught* by the mother to swim. This process being soon completed, the young are abandoned to their own ways, remaining near shore until the coats of fur and hair are fully developed. When the South Shetland Seals were first visited they had no fear of man, and would even show no apprehension when their fellows were being destroyed around them.

CAPE HAIR SEAL (*Arctocephalus ? nivosus*).—Dr. Gray has this recorded in *Cat. Seals and Whales in Brit. Mus.*, 1866, with a ? after the generic term. The fur of the Cape Hair Seal is very short, close-pressed, black in color, varied with close, small, often confluent, white spots; the under side of the neck with a few scattered, white hairs. The belly is red-brown (nearly bay); hairs are short and thick, and bearing one color to the base. There is no under fur, excepting a trifle upon the crown of the head. The specimen here described is in the British Museum; the skull, unfortunately, is not with it, and, therefore, there is no information concerning it. A synonym is A. ? nivosus, *Ann. and Mag. Nat. Hist.*, 1866. It is very different from A. antarcticus in the form and length of the hair, and by being almost destitute of under fur.

TRIBE IV—ZALOPHINA.

The molars in this group are $\frac{5}{5}$-$\frac{5}{5}$, large, thick, in a close continuous series, the fifth upper in front of the back edge of the zygomatic arch. The grinders are all single-rooted; in the younger skull they are placed rather further back, the hinder part of the upper molar being behind the back edge of the zygomatic arch. The last or sixth molar in each jaw, which is generally two-rooted, is absent. The face of the skull is produced considerably, and the forehead is flat.

ZALOPHUS.

This, the typical genus, has the palate concave, narrow in front, wider at the line of the last molar, and then contracted behind. The hinder nares are narrow, elongate, twice as long as wide, acutely arched in front, front edge in a line with the front edge of the orbital process of the malar bone. The under fur is sparsely set.

CALIFORNIAN HAIR SEAL (*Zalophus gilliespii*).—This is the Otaria gilliespii of Macbain; Arctocephalus gilliespii of Gray, *Proc. Zoöl. Soc.*, 1859, in which the skull is figured life-size; and Z. gilliespii of Gill and Allen. The localities of habitat are given as North Pacific, South California and Japan. Gray says he has not seen the skull from a Japanese specimen, and is, therefore, not able to judge whether it is the same as the Californian. He remarks that the species is at once known by the length of the face, and that a line drawn across the palate at the front edge of the zygomatic arch leaves one third of the palate behind the line, and two thirds in front. This is in all other species of the genus, but in this one it leaves only one fourth behind.

NEOPHOCA.

The palate in this genus is concave, broad, as broad before as at the hinder part of the tooth-line, then rather suddenly contracted; the hinder nares broad, rather longer than broad, with the front edge broadly arched, which is further back than the front edge of the orbital process of the zygomatic arch, or malar bone, which is thick and flat. There is very little under fur. The toe-flaps are moderately developed.

AUSTRALIAN HAIR SEAL (*Neophoca lobata*).—This species is Otaria australis of Quoy and Gaimard, *Voyage of the Astrolabe*; and Zalophus lobatus of Allen, in *Bul. Mus. Comp. Zoöl., Camb.* Mr. Allen considers this as undoubtedly the Otaria cinerea of Desmarest, from Peron. The upper grinders are all single-rooted, the root of the last two (the fourth and fifth) being rather compressed, with an obscure central longitudinal groove on the inside; the first two grinders of the lower jaw with oblong, the last three with compressed roots, and the fourth and fifth with a slight longitudinal groove on the side. In the younger skulls the roots of the grinders are more oblong, less compressed, and do not show the lateral grooves, as far as the teeth can be seen, without being drawn from the sockets.

TRIBE V—EUMETOPIINA.

The molars are $\frac{5}{5}$-$\frac{5}{5}$, more or less far apart; the hinder upper behind the hinder edge of the zygomatic arch, and separated from the other grinders by a concave space.

EUMETOPIAS.

There is no under fur to species of this genus. The palate is flattish, or rather concave in front, as wide in front as at the end of the tooth-line, and then slight-

ly narrowed behind. The posterior nares are oblong, elongate and broadly truncate in front, the front edge being behind the line of the orbital process of the zygomatic arch. The grinders have large oblong roots; the second, third and fourth upper ones have a sub-central longitudinal groove on the outer side, and a less marked one on their inner surface; the inner sides of all but the first of the lower ones are similarly grooved; the fifth upper grinder (or more properly the sixth in the normal series) has two distinct roots. The lower jaw is much more elongate than that of Otaria jubata; the hinder angle is more oblique, and the lower margin long and straight. The flap of the toes is short.

NORTHERN SEA LION (*Eumetopias stelleri*).—This Sea Lion has been, as Dr. Gray observes, one of the zoölogical paradoxes. Some confusion will, no doubt, continue to exist concerning the relations of the numerous forms of Otarines to each other, although observers are increasing and facts concerning their habits accumulating. We follow the arrangement of Gray, from the fact that the British Museum collections must have afforded him vastly more information than is likely to be at the disposal of any other person. The synonyms given of this Seal are: Arctocephalus monteriensis of Gray in *Cat. Seals and Whales* and *Proc. Zoöl. Soc.*, 1859; Eumetopias californiana, Gill, *Proc. Essex Inst., Salem, Mass.*, 1866; Otaria stelleri, Gray, *Cat. Seals and Whales;* Otaria (Eumetopias) stelleri, Peters, in *Monatsb*, 1866; Eumetopias stelleri, Gray, *Ann. and Mag. Nat. Hist.*, 1866, and Allen in *Bul. Mus. Comp. Zoöl., Camb.*; Leo marinus, Steller; Phoca jubata of Pander and D'Alton; and Arctocephalus californianus of Gray in *Cat. Seals and Whales*—a young specimen. California and Behring's Straits are the favorite localities of this Seal.

SEA LION OF STELLER.—Dr. Hamilton describes a form under this name in *Jardine's Nat. Lib.* He states that Steller records the length of the animal as about fifteen feet. His systematic name is given as Phoca jubata of Gmelin. It is described as having, in the males, a stiff and crisp hair about the neck, the females and young being entirely free from any such appendage. The females are shorter and more slender than their mates. The hide is very thick, and covered with coarse, strong hair of a reddish color, which is paler in old ones. The female has a bright ochre tint, the young approaching a chestnut. The head is large, and nose produced and upturned considerably. The eyes are very large, the inner angle being "stained, as it were," with cinnabar; the pupil exhibits a green color, the iris white; eyebrows are bushy; the ears conical, upright, large and distinct. The mane particularly distinguishes it, hence the name, though it is believed that only old males have it. This species is probably the Otaria jubata—see the same under the genus Otaria. This Sea Lion is only equalled in importance to the inhabitants of the Pacific Coast by the Fur Seals (Callorhinus). While having a very extended geographical range, it frequents the most remote and secluded places, as well as the thickly inhabited portions of the coast, entering the bays and harbors and rivers, often disporting fearlessly near the shipping, and quite habitually frequenting some particular rock or promontory, which it maintains with a persistence that only yields to superior strength or prowess. Capt. Scammon met with this species between the latitude of the Gallapagos islands, near the equator, and nearly to Behring's Straits, extending westward as far as the island of Saghalien, on the coast of Eastern Siberia. The captain says: "At the Farallones islands we saw the largest females we have ever met with on the California Coast. Hence, what we have formerly taken to be the Eumetopias stelleri may prove to be the Zalophus gilliespii; but if such be the fact, both species inhabit the coast of California, at least as far south as the Farallones. Moreover, both species herd together in the rookeries. A confusing variety exists in their figures, especially in the shape of the head: some have a short muzzle, with a full forehead; others with a forehead and nose somewhat elongated; and still others of a modified shape between the two extremes." Some doubt has formerly existed concerning the possible migration of this Seal. Scammon sets the matter at rest by exhibiting arrow-heads and spears, such as are used by the North Coast natives, which were found embedded in the flesh of individuals slain in the tropical seas. Prof. Davidson, of the U. S. Coast Survey, found a spear-head, such an one as is used by the natives of Alaska, in a large Sea Lion taken at Point Arenas, latitude 39°. The Sea Lion very closely resembles the Fur Seal, though the great spread of the hind flippers in the latter will at once suggest the difference. The largest Sea Lion measures about sixteen feet in length, from the nose to the end of the flipper. It yields about 40 gallons of oil; its weight being about 1000 pounds. A prominent feature, besides the glistening white teeth, is the stiff, bristly moustache. It is an interesting fact that the Mound Builders, whose works have been examined in Ohio and some of the Southern States, exhibited considerable skill in carving certain utensils; some of their pipes were elaborately worked in stone, the bowl usually representing some animal form. Among others, the Sea Lion is accurately represented, though these prehistoric people were thousands of miles away from the locality where a knowledge of the Sea Lion could be obtained. In one beautiful specimen of this kind of pipe, which is in the Davis Collection of the American Museum of Natural History, N. Y., the features of the Sea Lion are strongly marked, especially the stiff, elongated moustache. Like the Fur Seals, the Sea Lions appear to be able to live a long time without food, both the male and female remaining without eating during a considerable portion of the breeding season. The immense amount of fat which they carry no doubt supplies the system with nourishment during this season—they have a double coating of fat lying between the tissues. Having no fur, this Seal is of less value than others, but is yet prized for certain features, the testes being sold to the Chinese, who regard them as medicinal, and the

largest hairs of the moustache are used by them for personal ornament. The Sea Lion is said, on the authority of Capt. Scammon, to play upon the curiosity of the Penguin, and other large water birds, in such a manner as to draw them to the water, when it adroitly seizes their legs, and feeds upon the carcass. Formerly the skins of this Seal were of no value, but they are now sold for use as glue stock. Sea Lions inhabit the same regions as the Fur Seals, and often quite near the same rookeries. The natives drive them as they do the other forms, the time for doing so being at night. The most effective instrument for urging the unwieldy creatures on is found to be an umbrella, which, being opened and shut at intervals, is sure to excite the poor creatures to every exertion. Three days and nights pass in this operation, when the creatures are brought to the slaughtering place. As in the case of the Fur Seals, they are brought thus far to avoid the havoc which results from the killing, and which would otherwise unduly disturb the colony at the rocks.

ARCTOPHOCA.

Dr. Peters described this sub-genus from a specimen sent from Chile by Dr. Philippi. It differs from Zalophus mostly in the palate, which is narrower, but rather wider behind, and the teeth rather far apart. Gray says: "I have not seen any skull agreeing with these characters." This is described as having abundant under fur. "The form of the skull, and the large size of the orbits are very similar to those of Phocarctos hookeri, but the number and form of the teeth are different. In the *Monatsbericht*, May, 1866, Dr. Peters described and figured with considerable detail a skull of a Sea Bear, from Juan Fernandez, under the name Otaria philippi, forming for it a sub-genus, which he calls Arctophoca. In his revision of that paper, published in the same work for November, 1866, he places it as a synonym, or sub-species, of what he calls Otaria falklandica, which is my Arctocephalus nigrescens, and not the Otaria falklandica of Shaw, nor the O. falklandica of Burmeister, as Dr. Peters supposes, as I have shown above. In this paper he removes Otaria falklandica (that is, nigrescens) from the sub-genus Phocarctos, to which he referred it in his first paper, and places it in his sub-genus Arctophoca."—*Gray*.

CHILIAN FUR SEAL (*Arctophoca philippii*).—The synonyms are Otaria philippii, and Otaria hookeri—the first by Peters, and the other by Murie in *Proc. Zoöl. Soc.*, 1869. The habitat is recorded as Juan Fernandez Island. This form is a black-gray in color—grayish-yellow on the head and neck, brownish-black beneath; the base of the limbs a rusty-brown, and shining; the hair of the beard, in six rows, partly black, partly quite white, and partly black with white base. The thick under hair is rusty-red.

The preceding matter concerning the Pinnipeds is not particularly inviting to the general reader, but, it is hoped, will prove acceptable to the student who may not be able to consult the authorities. Great confusion has attended the examination and classification of these forms, and though several authorities have produced what they regard as satisfactory solutions, yet no doubt much more light will be forthcoming when larger collections of the individuals, the skins and skeletons, shall come to be examined by competent authorities. The British Museum has usually been the most liberally endowed with specimens suitable for study, and we naturally look to the labors of Dr. Gray, one of its most prominent curators, for a fair expression of results. We have searched very extensively for matter touching the habits of the Seals, but find little that is reliable. *Jardine's Naturalist's Library* contains a valuable stock of facts concerning every order of zoölogy, and has a fair stock of description on this particular subject; but the singular uncertainty of nomenclature renders it of doubtful service. We have, therefore, carefully selected such as is clearly of value, and have endeavored to avoid any possible confusion in the presentation of specific descriptions. In a paper, *Prodrome of a Monograph of the Pinnipeds*, communicated to the Essex Institute, in Salem, October, 1866, by Dr. Theodore Gill, the Seals are presented under a somewhat different arrangement from the preceding. The student desiring a thorough view of the subject will, of course, wish to consult that work, as well as the treatise of J. A. Allen on the Eared Seals, in the *Bul. Mus. Comp. Zoöl., Cambridge, Mass.*, 1870. The plan of the present work contemplates, while adhering as nearly as possible to the more generally recognized systems, an exhibition of the more recent individual views, particularly those of American naturalists. These will be presented in tables at the close of the volume. The valuable work by Capt. Scammon exhibits a very full account of a few prominent species.

ORDER VII.—RODENTIA.

THIS order, comprising the gnawing animals, is, by late authors, entitled *Glires*, Rodents. Two sub-orders are instituted: *Simplicidentati*, Ordinary Rodents, and *Duplicidentati*, Leporine Rodents—the latter embracing the Hare-like forms. Two other divisions are made, called Series: First, *Sciuromorpha*, Sciurine Rodents, and secondly, *Myomorpha*, Murine Rodents—the former including the Squirrels and allied forms, and the latter the Mouse-like animals. Eleven families are embraced in this arrangement. In modern scientific phraseology the Rodents are regarded as of the sub-class *Monodelphia*, or *Placentalia*, and as ineducabilian placentiferous mammals. The late magnificent work on the *Rodentia* by Dr. Coues and Mr. Allen—*Monographs of North American Rodentia, Hayden's Geological*

Report, 1877—furnishes a vast amount of valuable matter on this subject, and we deem it fortunate that we are enabled to present in this work a suitable digest of its contents under the appropriate heads.

This order is plainly distinguished by the peculiar shape of the cutting-teeth, which are singularly uniform in appearance throughout the whole group. It is characterized by having two incisors in each jaw, with one exception—the *Leporidæ*—which have a second rudimentary pair behind the upper incisors. The cutting-teeth are very large and long, and grow continuously in the form of an arc, or segment of a circle, which, were they not regularly worn at the points by mastication, would so develop as to form a curved tusk, or penetrate the roof of the mouth; in either event the creature is deprived of the usual means of subsistence, and dies. This happens occasionally, through accident, in several groups; the Woodchuck, *Arctomys*, and Rats are known to present remarkable instances. The wise provision here of a hard enameled exterior, and a softer inferior surface, secures a keen chisel-shaped edge, which serves for gnawing, a habit that suggests a name for the order —*Rodentia*, from the Latin, *rodere*, to gnaw. At the roots of the cutting-teeth are pulps, in which are constantly forming new substances for their growth. The continuous wear of a surface so unequal results in securing a cutting instrument, which has been imitated by man. Axes are made in the same manner, by introducing a piece of steel between two softer plates of iron, the wear of which produces similar results. In some instances the molars have the same provision as the incisors, the pulp furnishing a continuous growth. In extreme age some of the molars, from a lack of supply from the persistent pulp, throw out slender fangs that answer the purpose of roots, and then the upward growth ceases. The molars of Rodents generally are very complicated in structure, consisting of three portions—the hard enamel, which covers the dentine, or soft bony portion, and the cement, or *crusta petrosa*, which encircles the exterior of the enamel. Between the incisor teeth and the molars there is a wide space, the canines being entirely absent. The condyle of the lower jaw is rounded, and slides along the glenoid cavity longitudinally. The tibia and fibula of most Rodents are separate; in *Muridæ* and *Leporidæ* they are united, or anchylosed below. All have the clavicles more or less developed; the Porcupines have none, and those of the Hares are quite reduced in size. The feet have the normal number of five toes, the thumb being more or less rudimentary. The hind feet have five toes in most genera, but in some only four are seen; there are only three in Cavia, Dipus and Dasyprocta. All have prehensile feet, excepting the Hares and Cavies. The intestinal canal is long in most, and has a well-formed cœcum; in Myoxina there is none.

Members of this order are known to all portions of the globe, and are particularly abundant in America, where there are said to be as many as exist in all other parts of the world together. The order contains more species than any other of the class of mammals, between eight hundred and nine hundred being known; and they are very evenly distributed. In South America there are more than in the northern half of the New World, but the great numbers of species included in the one genus, Hesperomys, cause this preponderance. There are no indigenous Rodents common to both Europe and America, excepting the Beaver, which is regarded by some as the same in both countries. The Musk-rat, and a species of Spermophilus are said to occur in Kamtschatka; in this event these would hold as exceptions. There are no South American species in North America, but a close relationship exists between the genera. Wallace gives the following as regards the families of Rodents, and number of genera and species: *Muridæ* has thirty-seven genera and three hundred and thirty species. The true Mouse (*Mus*), he records, is not found indigenous in North nor South America, nor in three insular groups belonging to the Australian region, but is indigenous in the remaining portions of the globe very widely. Hesperomys represents it in the New World; eighty or more species are enumerated. *Spalacidæ* is exclusively of the Old World, and has seven genera and seventeen species. *Dipodidæ* has three genera and twenty-two species. This is an Old World group, excepting Jaculus, or Meriones, with one species. *Myoxidæ* has one genus and twelve species, all foreign. *Saccomyidæ* has six genera and thirty-three species, all North American. *Castoridæ* has one genus and two species, American and European. *Sciuridæ* has eight genera, and one hundred and eighty to two hundred species. These are largely from North America and Europe and Asia, but are absent in West Indies, Australia and South America, as far north as Paraguay. *Haplodontidæ* has one genus and two species, both American. *Chinchillidæ* has three genera and six species, all South American. *Octodontidæ* has eight genera and nineteen species, South American and African. *Echimydæ* has ten genera and thirty species, which are found in South America and Africa. *Cercolabidæ* has three genera and thirteen to fifteen species, all American. *Hystricidæ* has three genera and twelve species, all Old World. *Cavidæ* has six genera and twenty-eight species, all American. *Lagomyidæ* has one genus and eleven species, common to both worlds. *Leporidæ* has one genus and from thirty-five to forty species, common to both hemispheres.

The two sub-orders are regarded as very clearly defined. In the first sub-order, *Simplicidentati*, the incisors, or cutting-teeth, are limited to two in each jaw, the enamel being entirely confined to the front surface of each tooth. There is a true alisphenoid canal, and an external one in the skull. The fibula never articulates with the calcaneum. The testes are abdominal, but descend periodically. Nineteen families are enumerated as belonging to this sub-order. The *Duplicidentati* are characterized by having four cutting-teeth in the upper jaw and two in the lower; the external ones in the upper jaw are very small, and situated somewhat subordinate to the others. In early

life six incisors are present. The enamel of the incisors of this sub-order is present on both sides, but is considerably thinner behind. The skull has no true alisphenoid canal. The fibula articulates distally with the calcaneum. The testicles are externally situated. Two families only are known.

Fossil Extinct Rodents.

Members of this order are regarded as of very ancient lineage, some of the present living being represented as far back as the Eocene. We are mostly indebted to the labors of Professors Marsh, Leidy and Cope for our knowledge of these forms. Among others who have discovered and described them may be named Prof. B. F. Mudge, of Kansas.

SCIURIDÆ.—The bone caverns of Pennsylvania have yielded remains of extinct species of Tamias and Sciurus. The remains from the Tertiary deposits of the Western Territories, with one exception which is doubtful, are all of extinct genera. The genera Paramys and Sciuravus are abundant in the Eocene deposits. These animals were, apparently, of size ranging from the Red Squirrel to those one fourth larger than the Woodchuck. Other forms are genera Taxymys, *Marsh;* Tillomys, *Marsh;* and Heliscomys, *Cope.*

Sciurus calycinus, Cope, is an extinct species found in the Port Kennedy Bone Cave, Penn. About the size of the S. hudsonius.

S. panolius, Cope, is from caves of Wythe County, Va. Smaller than the preceding by a third.

S. relictus, Cope, is about the size of the Chickaree. From the Tertiary of Colorado.

Tamias lævidens, Cope, is from the bone cave of Wythe County, Penn.

Arctomys vetus, Marsh.—This was about one third as large as the Arctomys monax, and is from the Loup Fork Pliocene, Nebraska.

Paramys robustus, Marsh.—This was somewhat larger than the Woodchuck, and is from the Lower Tertiary deposits of Grizzly Buttes, Wyoming.

P. leptodus, Cope, is about the same size, with smaller incisors. Locality, South Bitter Creek, Wyoming.

P. delicatus, Leidy.—About one fourth less than the former. From the Eocene beds near Fort Bridger, Utah.

P. delicatior, Leidy.—Rather smaller than the preceding. Same locality.

P. delicatissimus, Leidy.—Smaller than either the preceding, and from same localities.

Sciuravus nitidus, Marsh.—This is about the size of a Brown Rat. Grizzly Buttes, Wyoming.

S. nudans, Marsh.—Rather larger than the preceding. From same locality; and, by Prof. Cope, from Upper Green River, who refers it to Paramys.

S. parvidens, Marsh.—Half the size of the last, with the teeth differing considerably. Henry's Fork and Grizzly Buttes, Wyoming. Another species is described by Dr. Leidy, who regards it as somewhat doubtful as to the genus.

Heliscomys vetus, Cope.—This genus is something like the *Muridæ;* the species is smaller than S. hudsonius, and is recorded by Mr. Allen as "the smallest mammal of the Fauna to which it pertains." From the Tertiary of Colorado.

Mysops fraternus, Leidy, is about the size of a Mouse, and is found in Grizzly Buttes, Wyoming.

M. minutus, Leidy.—Size of the last. Wyoming.

Colonomys celer, Marsh.—About half the size of a Brown Rat. Henry's Fork, Wyoming.

Taxymys lucaris, Marsh.—Rather smaller than the Flying Squirrel. From same place.

Tillomys senex, Marsh.—About the size of a Rat. Same.

T. parvus, Marsh, is a smaller species from Grizzly Buttes, Wyoming.

The *Sciuridæ* are represented in Europe, in the Upper Miocene, by Spermophilus and Sciurus; in the Newer Pliocene by Arctomys. In the Miocene of Europe, also, are Brachymys, Lithomys and Plesiarctomys; the latter is intermediate between the Marmot and Squirrels. Wallace expresses the belief that the Squirrels are of an Old World type, and that they have entered the New World recently in a geological point of view.

CASTORIDÆ.—Fossil remains of the Beaver have been found in New York and other States, associated with remains of Castoroides; they are found in the Post Pliocene and in the Tertiary.

Eucastor tortus, Leidy.—This is an extinct genus, found by Dr. Hayden on the banks of the Niobrara River; it was smaller than the Marmot or Woodchuck.

Steneofiber nebrascensis, Leidy.—This is another extinct form from the White River, Dakota, on the Bad Lands; it was about the size of the former.

S. pansus, Cope.—This is a recent discovery from the Santa Fé Marl Beds; it is closely allied to the preceding.

In Europe one species is found extinct in the Upper Miocene. Trogontherium is an extinct genus from the Post Pliocene of Europe, and another—Chalicomys—is from the same.

ISCHYROMIDÆ.—This is an extinct family, named by Mr. E. R. Alston (*Proc. Zoöl. Soc., London,* 1876), to receive Prof. Leidy's genus Ischyromys. The dentition is as in *Sciuridæ.* The skull resembles *Castoridæ,* but with the infra-orbital opening large, a sagittal crest, no post-orbital process, palate broad, basi-occipital keeled.

Ischyromys typus, Leidy.—About the size of a Musk-rat; the form of skull somewhat resembling that of the Beaver. From Bad Lands, Dakota.

Gymnoptychus chrysodon, Cope.—Four species of this extinct genus are described by Prof. Cope. S. minutus is "scarcely larger than a House-mouse."

Pseudotomus hians, Cope, is another form, about the size of the Agouti, having characters of Arctomys, Fiber, and some others. Locality, Bad Lands, Dakota.

MYOMORPHA—MURIDÆ. *Eumys elegans, Leidy.*—In the Bad Lands of Bear Creek, Dakota, Dr. Hayden found a portion of the lower jaw, which indicates an animal the size of a Brown Rat, the genus being extinct. *E. coxodon, Cope.*—A similar form to the pre-

ceding. From Santa Fé marls. *Neotoma magister, Baird.*—This living genus has an extinct species, named as above, found in the caves of Pennsylvania, at Harrisburg and Carlisle. It is based on a number of under jaws, which average somewhat larger than those of the existing species. *Arvicola* (*Isodelta*) *speothen, Cope.*—This and several others mentioned below are extinct species found in the bone caves of Pennsylvania, at Port Kennedy. *A.* (*Pitymys*) *tetradelta, Cope; A.* (*Pitymys*) *didelta, Cope; A. involuta, Cope; A. sigmodus, Cope; A.* (*Anaptogonia*) *hiatidens, Cope.*

GEOMYIDÆ. *Geomys bisulcatus, Marsh.*—From the Pliocene of Camp Thorne Loup Fork, Northern Nebraska. *Colotaxis cristatus, Cope.*—An extinct genus from the "Tertiary of the Plains." There are three molars, with plicate crowns, two connecting cusps, with crescentic section on the outside, each of which gives rise to two transverse crests, which are unconnected. Of these crests, the anterior and posterior are marginal and less developed than the median pair. The intervals are deep, without cement.

HYSTRICOMORPHA—HYSTRICIDÆ. *Hystrix venustus, Leidy.*—This is an extinct species from the Pliocene of Dakota. Dr. Leidy says: "They apparently indicate a species of Porcupine, but in structure are unlike those of the recent American Porcupine (*Erethizon dorsatus*), and exhibit a more evident relationship with those of the Crested Porcupine (*Histrix cristata*) of Europe." It is well known that the latter is not found living in America; consequently, this discovery is interesting, as introducing for the first time an Old World form of this family into our Fauna.

Erethizon cloacinum, Cope.—This is an extinct species of the present genus of American Porcupines, found in Port Kennedy caves, Penn.; determined from teeth, which exhibit a larger average size than those of the living species. In the Pliocene and Miocene of Europe, some forms of this family are found.

CASTOROIDIDÆ.—This is an extinct family allied to *Castoridæ*, and has a representative in Castoroides ohiensis. This "Fossil Beaver" was a most remarkable animal, its size being about that of a common Black Bear. A skull of this species measures over twelve inches in length, exceeding considerably that of the largest living Rodent—the Capybara. Certain anatomical features of the skull indicate that the habits of this animal differed greatly from the modern Beaver. The discovery of portions of a jaw and teeth at Nashport, Ohio, and described by Dr. Foster, first brought the animal into notice. Dr. Wyman afterwards found the ramus of a lower jaw in Memphis, Tenn., and Dr. Leidy other fragments in South Carolina and in Illinois. Mr. Boll, of the Cambridge Museum, found some remains in Texas, in the alluvial deposits on Trinity River, associated with remains of the extinct Horse and the Mastodon. "The skull of this animal resembles the Castor, or Beaver, but the cranial portion is relatively very much smaller and more flattened, and the facial portion much larger than in that genus. The zygomatic processes arise at a much higher point, and the zygomatic arch is much less curved downwards. In Castor, on the contrary, it reaches the small lachrymal, by which only it is separated from the anti-orbital process of the frontal. The narrowest portion of the skull is behind the middle, instead of anterior to it, as in Castor. The basilar cavity seen in Castor is entirely wanting, and the auditory bullæ are smaller. The molars differ strikingly in structure, not only from Castor, but from those of all other Rodents, except the *Chinchillidæ*, a near resemblance being met with elsewhere only in the last molar of Hydrochærus. They consist of a series of laminæ of dentine completely inclosed by enamel, held together by a thin coating of cement. The circumference of the triturating surface of the tooth is thus devoid of the continuous plate of enamel that forms an uninterrupted border in the molar teeth of ordinary Rodents, and is deeply serrated. The molar teeth are essentially different from those of Castor, with which genus this form is usually compared." Many other points of difference are recorded, which, with the above, are found in Prof. Hayden's Report on *Rodentia*, before alluded to. The report also continues: "It will be seen that Castoroides presents a singular combination of characters, allying it on the one hand to the Beaver, and on the other to the Chinchillas and Viscachas, and also to the Musk-rat, but which, at the same time, separate it widely from either group." In size Castoroides exceeded any living Rodent, and is itself exceeded in this order by only a single extinct form of Hydrochœrus, described by Lund, from the bone caves of Brazil. From the wide differences noticed between this and its well-known allies, it is placed by itself as a type of a distinct and hitherto unrecognized family. The genera Amblyrhiza and Loxomylus, described by Prof. Cope, from the bone caves of Anguilla Island, West Indies, are referred to this group. The former has one species—A. inundata, Cope; the latter two—L. longidens, Cope, and L. latidens, Cope.

HYDROCHŒRIDÆ. *Hydrochærus æsopi, Leidy.*—In the Post Pliocene of the Ashley River, at Charleston, S. C., were found teeth referred to this genus, which includes the largest living Rodent—the South American River Hog (*H. capybara*). These teeth differ from the existing form, and Dr. Leidy has established the above species. In the Brazilian Caves this family is represented, associated with Cœlogenys, Dasyprocta and Kerodon. The last named is abundant in the Pliocene of La Plata. Cavia and Dasyprocta are found in the Miocene of Switzerland and France. No well-marked extinct genus of this family has been found.

LEPORIDÆ.—The Hares exhibit several extinct genera in the Miocene deposits of Dakota and Colorado. Like the preceding forms, they are represented by only a few fragments of jaws and teeth, and none were of any considerable size over the ordinary living species.

Palæolagus haydeni, Leidy.—This was formerly called Tricium by Cope, several hundred specimens having been examined by the latter naturalist. A

detailed account of the peculiarities is found in Hayden's Report, *Rodentia*, 1877, where also will be found the references to original descriptions.

P. agapetillus, Cope, is smaller than the preceding, with larger incisors. A larger is *P. turgidus, Cope*, and another form is *P. triplex*, each from the same.

Panolax sanctæ-fidei, Cope, is named from its locality, Santa Fé. It was about the size of the common Northern Hare. This genus is not clearly defined, according to the author, and is provisionally recorded.

Praotherium palatinum, Cope, is from the Port Kennedy Bone Cave, Chester, Penn.

Fossil remains of existing species are found in the various bone caves of America, associated with other Mammalia. In the crevices of lead-bearing rocks of Illinois, and in the Post Pliocene deposits of Ashley River, in Charleston, S. C., they are found. Lepus braziliensis occurs in the caves of Brazil. Lepus occurs in the Post Pliocene of France. A gigantic animal, which has received the name Toxodon, is considered to have close affinity with the Rodents. The species T. platensis had incisors like the Hare. Prof. Owen remarks: "The dentition closely resembled the Rodent type, but manifested it upon a gigantic scale, and tended to complete the chain of affinities which link the Pachydermatous with the Rodent and Cetaceous orders." D'Orbigny has later determined, from a discovery of another species, the fore-arm being secured, that the creature had limbs not unlike the Tapir and Capybara; to the latter it bears most resemblance. It is judged that its length must have been from twelve to sixteen feet. The skull was two feet four inches in length, and one foot four inches across its breadth. The family *Toxodontidæ* is formed to admit the two species. The remains were found in South America, near Bahia Blanca, by Mr. Darwin.

The *Dipodidæ*, an Old World family, is represented by extinct forms in the Miocene of the Alps and in France, the *Myoxidæ* in the Maltese caverns, and in France and Switzerland.

The extinct group *Hebetidentati*, nearly allied to the Rodents, has some peculiarities of dentition. There are two incisors in the upper jaw, and four in the lower, the outer ones of the lower jaw very small. The enamel is continuous around the teeth; the crowns are transversely hollowed, and the points chiseled. The fibula articulates with the calcaneum. One family only is recognized—the *Mesotheriidæ*—of which one species is known, from the Pliocene of South America.

Extinct *Chinchillidæ* are found in the caves of Brazil and in the Post Pliocene of La Plata. Species of the family *Octodontidæ* are found in Pliocene of La Plata. The Eocene of South America produces Megamys, an extinct genus, allied to Capromys, both of this family. In Europe, the Lower Miocene yields two extinct genera of the same—Palæomys and Archæomys.

The family *Echimyidæ* is represented in the Brazilian caves by an extinct species of the genus Carterodon, and the extinct genera Myopotamus, Loncheres, Lonchophorus and Phyllomys. In the Upper Miocene of France there are numerous species of the extinct genus Theridomys, allied to *Cercolabidæ*. In the Upper Miocene of Germany is an extinct genus, Aulacodon. The Brazilian caves produce a large species of Cercolabes.

Lagomyidæ.—Extinct forms of this family are seen in the Post Pliocene of Europe. In the Miocene of France and Germany is found the extinct genus Tilanomys.

FAMILY—SCIURIDÆ.

The Squirrels are the typical forms of this family. The dental formula is now stated as follows: Incisors, $\frac{1}{1}-\frac{1}{1}$; Premolars, $\frac{2}{1}-\frac{2}{1}$ or $\frac{1}{1}-\frac{1}{1}$; Molars, $\frac{3}{3}-\frac{3}{3} = \frac{12}{10}$ or $\frac{10}{10}$. The molars are rooted, with tuberculated crowns during youth; the tubercles soon become much modified, or nearly obliterated by attrition, giving the form of transverse ridges. The first upper premolar, when two are present, is often minute, and is generally much smaller than the second. The feet are either scansorial (fitted for climbing), or fossorial (suited to digging in the earth). Perfect clavicles are present, and nearly perfectly free fibulæ. There is a small, naked muffle, and a cleft upper lip. The Sciurines are found throughout all the continental portions of the world, excepting Australia, but are notably more numerous in the northern hemisphere. The genus Sciurus is universally distributed, with the above exception. Cynomys, on the other hand, is limited to a small portion of North America. Spermophiles are more numerous in the latter country. Pteromys occurs only in the tropical portions of Asia, and Xerus in Africa. In South America the Sciurines are represented only by the genus Sciurus, and by a few species only. They are more abundant in Central America, and the genus Sciurus is found to have more species in Southern Mexico than in any equal area in the New World. In the United States, not over three species are found in one locality together, and north of that, not over one is known. Europe has a single species; but they occur somewhat more abundantly in Asia and Africa. The forms under consideration have been the subject of minute investigation, and much confusion has of late been dispensed by the assiduous labors of our American naturalists. Since the year 1850, the North American Sciuri have been reduced in numbers from twenty-seven species to six, with six or seven additional geographical races or sub-species. "The species," says Professor Baird, "exhibit an unusual tendency to run into varieties of color, among which gray, red and black are the predominating ones, with all possible intermediate shades. These varieties are sometimes more or less constant in particular localities, sometimes changing with every litter." This group of Rodents seems particularly to have a tendency to *melanism*, the opposite of *albinism*. There are jet black Squirrels, and occasionally pure white ones, with the pink eyes that are characteristic of this condition.

SCIUROPTERUS.—*F. Cuvier.*

This genus is characterized most remarkably by the extensive expansion of the skin between the fore

and hind-feet. The creatures are enabled by this structure to glide from the tops of tall trees to the ground, or from one tree to another, as a parachute falls through the air. They cannot fly as the Bird, nor even as the Bat. This genus is merely a modified form of Sciurus, possessing rudimentary powers of flight. The species are crepuscular in habit, or nocturnal. In North America one species is known, but its distribution is widely extended; its size, too, varies extensively, according to its locality. A single species is found in Europe, and Asia has several. The European species is much smaller than ours.

AMERICAN FLYING SQUIRREL (*Sciuropterus volucella, Pall., Geoff.*)—Plate 14, fig. 43—is one of the several varieties formerly called by a distinct name from others. In the late work on *Rodentia*, by Allen and Coues, it is called the SOUTHERN FLYING SQUIRREL. Its length, exclusive of the tail, is less than six inches, generally less than five and a half. The tail is said to be less dusky, often with no blackish whatever, and the general color of the body above rather more yellowish. It inhabits the United States—exclusive of the Pacific slope north of California, and the Rocky Mountains north of Colorado, and thence southward to Guatemala. This little creature was described as early as 1651 by Fernandez, from Mexican specimens, and, in 1743, Catesby recorded it from South Carolina. Prof. Baird, in *Mammals of North America*, 1858, admitted four species, but the question is now fairly settled upon the present basis, that is—one species, with several variations. The variety hudsonius—the NORTHERN FLYING SQUIRREL—is regarded as attaining a length of six inches or more. The color above is a dull yellowish or reddish-brown. Its habitat is mostly north of parallel 49°, extending further southward along the Rocky Mountains and on the Pacific slope. Although these are regarded as somewhat distinct varieties, yet our authors consider them as "grading insensibly into each other." The Flying Squirrel is a gentle little creature, easily tamed, and one that proves a very pleasant pet. It is frequently kept in a tamed state by the country people.

SCIURUS.—*Linn.*

The generic characters are in part a short and very broad skull, the cranial portion being greatly expanded; the post-orbital processes terminate in a long slender point, directed posteriorly (and more or less outwardly) and decurved; the malar bone is slender, the plane of its expression being nearly vertical; the anti-orbital foramen, a narrow vertical slit, opening far in advance of the first premolar. The upper molars are four or five; the first premolar, when two are present, very small. The muzzle is short, and the nasals greatly narrowed posteriorly. The ears are well developed, sometimes tufted, especially in cold weather. In this genus there is absent the well-marked black stripes on the dorsum. There are no cheek pouches, and no lateral membranes connecting the limbs. The authors of *Rodentia*, Hayden's Report, 1877, have had unusual facilities in the examination of species of this genus, and we find that they have reduced the number of species from "some thirty or more to nine or ten that seem valid, with two additional sub-species." The smallest species is the most northern in habitat, and the next smaller is in the extreme South. In the sub-tropical regions are the largest, with fine bushy tails. "None are thus far known from the inter-tropical islands."

CHICKAREE (*Sciurus hudsonius, Pallas*).—Among the several varieties this is called the EASTERN CHICKAREE. Its average length from end of nose to base of tail is six and three-quarter inches; its fur above is a pale gray fulvous; below, pure white. The ears are blackish toward the end, and in winter are pencilled or tufted. The middle of the back is generally red, and there is a short black line laterally. This is, in the Northern States, the most familiar animal of this order, or perhaps equally so with the little Striped Squirrel. It is a noisy little creature, pretty surely met with in any dry woods, either running up and down some tall tree, or leaping gayly along the stone wall, uttering now and then the twittering chirp, *Chick-a-ree!* which suggests its name. It feeds on cones of the fir, hickory and other nuts, and also on the seeds and buds of other trees. The Sable is said to be its greatest enemy. It dives and swims, upon occasion, when closely pushed. A variety, called RICHARDSON'S CHICKAREE (*S. richardsoni*), is about seven and a half inches in length. This variety is found in the Rocky Mountains.

THE WESTERN CHICKAREE (*S. douglassi*) is another mere variety of the preceding, measuring the same in length; it is found in the Western States. The variety S. fremonti has a length of body seven and three-quarter inches; it ranges from the eastern base of the middle portion of the Rocky Mountains to the Pacific. The four varieties of the Red Squirrel are thought to be readily distinguishable by the coloration, especially by the markings of the tail. The variety hudsonius is smaller than others; the others do not differ materially in size. All the varieties, except fremonti, have a distinct reddish band along the middle of the back, which extends from the top of the head to the end of the tail. In hudsonius it is yellowish-red; in others it is much darker tint. All are white or grayish-white below, except douglassi, which has that surface fulvous. A conspicuous black lateral line is more or less prevalent in summer in all of them. The habitat of this Squirrel includes the entire continent.

THE GRAY SQUIRREL (*Sciurus carolinensis, Gmelin*).—The Gray Squirrel is familiar to those living somewhat remote from the large towns, and throughout the continent three varieties are noticed. Variety leucotis has a length of body ten and a half inches, varying from nine to eleven and a half. The pelage above is a whitish-gray, with a dorsal area and lateral line of yellowish-brown; beneath, it is white. It is found in the New England States, Canada, and as far west as Iowa.

The variety carolinensis, the SOUTHERN GRAY SQUIRREL, ranges in length from eight and a half to

ten and a quarter inches. Above, the pelage is brownish-yellow, varied with black, with generally the sides of the neck, shoulder and thighs mixed with whitish; beneath, it is white. It is found in Florida and other Gulf States.

The variety yucatanensis, the YUCATAN GRAY SQUIRREL, is small in size, intermediate between the carolinensis and hudsonius; its length being ten inches. It has a coarser and hard pelage. The ears are narrow and pointed; in winter somewhat tufted. Above, the hair is gray, with the middle of the back brownish; beneath, it is white; the hairs of the tail are ringed with white and black. Its habitat is Yucatan, Mexico and Guatemala. The New England variety shows, in a large proportion, no signs of the central dorsal area of brown. In the Middle States, and some of the Western, the specimens show it very distinctly.

The Gray Squirrel ranges eastward as far as New Brunswick, and extends westward to the mouth of the River Platte, and thence southward to the gulf, reaching to Nebraska and Mexico. It feeds upon nuts, seeds and berries, and builds its nest in the hollow branch of some tree, four to six young being produced at a birth. During the breeding season they are exceedingly pugnacious, but the stories of emasculating each other are untrue. A remarkable peculiarity of this species is its habit of migration. Dr. Bachman describes an instance which he witnessed, in the autumn of 1808, a short distance above Albany. On that occasion troops of Squirrels suddenly made their appearance. They swam the Hudson in some places, between Waterford and Saratoga. Those which were noticed crossing the river were swimming deeply and awkwardly, with their bodies and tails wholly submerged. Many were drowned, and those which were so fortunate as to reach the opposite bank were so wet and fatigued that they were readily killed. On that occasion their migration did not extend further than the mountains of Vermont. The motive for this unusual movement was supposed to be a temporary failure of supplies of requisite food.

FOX SQUIRREL (*Sciurus niger, Linn*).—Three varieties of this form are seen. The NORTHERN FOX SQUIRREL, variety cinereus, has a length of body twelve to thirteen inches, varying to fourteen inches. It is a whitish-gray above, yellowish-white beneath, with edges and under surfaces of the tail fulvous, varying to rufous below. Varieties are seen with under surfaces, legs and feet blackish. Audubon and Bachman call it the Cat Squirrel. Its range is along the Atlantic States, from Virginia to Southern New England. Prof. Baird says: "Specimens from St. George's County, Maryland, are more 'foxy' than any described. It abounds in the Middle States, and is called there Fox Squirrel and Cat Squirrel." Variety niger, SOUTHERN FOX SQUIRREL, is larger, being thirteen and a half inches in length, ranging from twelve to fifteen. The color is variable; the nose and ears are whitish, usually contrasted strongly with the dorsal color, which is generally gray. In dusky varieties the head is often quite black. It is distinguished from the preceding by its whitish nose and ears. It is found in the Gulf and South Atlantic States, from Maryland to Louisiana. The Western variety, ludovicianus, is smaller than the preceding, about the size of the cinereus; its body is about twelve to thirteen inches in length, ranging from eleven to fourteen. Above, it is a dusky gray, with a prominent rufous cast; the ears, feet and ventral surface are fulvous, varying to bright ferruginous. This is found in the Mississippi region.

CALIFORNIA GRAY SQUIRREL (*Sciurus fossor, Peale*).—The special characteristic of this form is its constancy of coloration. Its length is twelve to thirteen inches, ranging from ten and a half to twelve and a half inches. The color above is a clear plumbeous-gray; beneath, it is pure white. There is no lateral line. This species differs from the Eastern Gray Squirrel (*S. carolinensis*) in its larger size, and tail being relatively much longer; the gray of the upper parts, also, lacks the suffusion of red or fulvous, which is seen in the latter; it is also purer white below. The present species is wholly restricted to the Pacific slope, none being found hitherto east of the Sierra Nevada and Coast ranges of mountains. Its nearest relative is the S. colliæi of Mexico, a form of the same size and relative length of tail; its coloration is, however, different. The melanistic variety has not appeared in this species.

ABERT'S SQUIRREL (*S. aberti, Woodh.*)—This is described by Prof. Baird as S. castanonotus (*Mam. N. A.*, 1859). It is eleven inches in length; the tail to end of hairs twelve more. Its color above is a plumbeous-gray, with generally a more or less broad dorsal area of reddish-brown; beneath, it is pure white; the sides of the body have a more or less distinct black line, separating the white of the under parts. Black varieties are noticed, varying from brownish to jet black. The tail is centrally black above, with broad white edges; the under part wholly white. The ears are very large; in winter with long pointed tufts, one to one and a half inches in length, and are larger than those of any other species. The brownish color of the back varies from a yellowish to a strong reddish and chestnut; this area varies in width from a narrow line to the whole width of the back, occasionally being wholly wanting. In some a small chestnut-colored spot is seen at the base of the ear. The geographical range is from Central Colorado to the Apache Mountains of Arizona.

COLLIE'S SQUIRREL (*S. colliæi, Rich.*)—The specific characters of this species are seen in the coloration, and in the ears being considerably shorter and smaller, not half as large as in the preceding species; it also has a shorter tail, more brownish gray of the upper surface, and a yellowish-brown dorsal area, which covers nearly all the back. There are no ear tufts, and no lateral lines. The length of body is twelve and a half inches; the tail to end of vertebræ eleven inches; the latter to end of hairs fourteen inches. Mr. Collie found this species common on the west coast of Mexico.

THE VARIED SQUIRREL (*S. boothiæ, Gray*).—This is S. variegatus of Erxleben, 1777; S. rigidus of Peters, 1863–4; S. intermedias of Verreaux; and several other synonyms are recorded. Its form is stout; muzzle short and broad; its ears rather small. The tail is narrow, and somewhat longer than the head and body. The pelage is full, coarse and long. The length of head and body is twelve and a half inches; of the tail to the end of the hairs, twelve and three-quarter inches. Its color above is dark brown, mixed with yellowish-gray or black, with a shade of fulvous; the sides are often paler, and an indication in some of a broad grayish sublateral band; beneath, it is deep brownish-red; frequently it has unsymmetrical patches of white. The coloration of this species varies so much that authors regard it as difficult to settle upon one satisfactory description. The above is regarded as intermediate between the extremes, though it is but an epitome, as most of our present matter must necessarily be.

FIRE-BELLIED SQUIRREL (*S. hypopyrrhus, Wagler*).—This is S. nigrescens of Bennet (*Proc. Zoöl. Soc., Lond.*, 1833); Macroxus nigrescens, Gray; and S. griseocaudatus, M. colliæi, M. dorsalis, M. maurus and M. melania of same (*Ann. and Mag. Nat. Hist.*, 1867). Its specific characters are seen in its slenderness, the great length and narrowness of its ears, and the remarkable length of its tail, which, with the hairs, is one fifth to one fourth longer than the head and body. It is a common form in Southern Mexico and Central America, southward to Ecuador; it also is found on the west coast of South America, S. griseocaudatus of Gray being found to be the same as this, as well as S. variegatoides of Ogilby. This species is large, but slender. The length of body is ten and a half to twelve and a half inches; tail to end of the hairs is twelve and three-quarter to sixteen inches. The color is variable, and a strong tendency is seen to both albinism and melanism. The pelage is coarse and harsh.

RED-BELLIED SQUIRREL (*S. aureigaster, F. Cuvier*).—This is S. ferruginiventris of Aud. and Bach.; Macroxus aureogaster and M. morio of Gray (*Ann. and Mag. Nat. Hist.*, 1867). The head and body measure ten and a half inches; tail to end of hairs eleven and a half inches. The pelage is soft and full. The color above is a clear dark gray; beneath, it is a deep reddish-orange, which blends with the gray of the sides, extending often high upon the shoulders, occasionally meeting on the back. The sides of the head and chin are a light gray. The tail is tricolored below, centrally it is a deep reddish-orange, then black and white edged; the upper surface is black and white mixed. The color is said to vary less than in most other Mexican varieties. This species is not seen north of Mexico.

GOLDEN-BELLIED SQUIRREL (*S. leucops, Gray.*)—This is S. aureogaster of Geoffroy; Macroxus griseoflavus and M. leucops of Gray (*Ann. and Mag. Nat. Hist.*, 1867.) The length of this form is twelve and a half inches; the tail, with hairs, twelve to thirteen inches. The pelage is soft and full. The color above is gray, varying from a whitish-gray to a dark iron-gray, often having a patch of yellowish-rusty on the nape, and a considerable area of the same on the rump; beneath, it is a pure white, a yellowish white, or deep golden. "The pelage of the whole upper surface is generally with a broad subterminal band of yellowish or golden, sometimes showing faintly through the surface." This species was first described by Geoffroy, the naturalist of the French ship Venus, in 1855, from specimens found at Monterey.

BRAZILIAN SQUIRREL (*S. æstuans, Linn.*)—A large number of synonyms are appended to this species. Pennant called it as above, and Buffon has it *Le grand Guerlinguet.* A variety, called S. rufoniger, is Macroxus irroratus and M. griseogena of Gray. The variety æstuans has a body much smaller than any preceding, being seven to eight inches, and the length of tail, including the hairs, nine to nine and a half inches. The ears are of medium size, and rounded. The tail is narrow, and distichous till near the terminus, when it is more cylindrical. The pelage is soft and short. The general color above is a dark olivaceous-brown, minutely varied with fulvous or pale rufous; beneath, including the insides of the limbs, it is generally a reddish-yellow, varying from a pale rufous to fulvous. The tail is yellowish-brown, ringed with black. There is a ring of yellowish around each eye. The sides of the muzzle, chin and throat are yellowish-white. This species presents no marked variations in color, and is not seen to vary much with locality. No melanistic specimens have been seen. The specimens examined by Mr. Allen are from Brazil.

The variety rufoniger is larger than the preceding æstuans, the length being eight and three-quarter inches; of tail to end of hairs nine to nine and three-quarter inches. Little difference in coloration is seen; the dorsal surface is a little darker and redder, and the lower parts rather lighter; the tail is also washed yellowish-red, instead of very pale yellow, and the black rings are broader and darker; the latter coloration is regarded as quite noticeable, as distinguished from the æstuans. The specimens examined by Mr. Allen are from Costa Rica; those from Venezuela are smaller.

ORIZABA SQUIRREL (*S. tephrogaster, Gray, Allen*).—This is Macroxus fraseri of Gray, and several other forms are referred by him to the same genus, formerly described under different names, as M. middellinensis and M. tæniurus. This is the same in size as the preceding. The color is dark olivaceous above, with minutely varied yellow or rufous. The middle of the back is darker than the sides, and with less rufous. Beneath, it is whitish-gray or fulvous, varying in different specimens from nearly pure white to orange. The tail above is black, with white washings; below, it is reddish-brown, ringed with black centrally, with a broad subterminal bar of black, ended with whitish tips. This species is from Central Guatemala and Mexico.

GERRARD'S SQUIRREL (*S. gerrardi, Gray*).—This is Macroxus gerrardi of Gray; M. brunneo-niger of Castelnau; M. xanthotus of Gray; and M. ignitus

of same. It is intermediate in size between S. variabilis and S. rufoniger; its length is nine and a half inches; of tail to end of hairs ten inches. It is from Panama and Central America generally.

PERUVIAN SQUIRREL (*S. variabilis, Geoffroy*).—Gray described this as Macroxus fumigatus, *Ann. and Mag. Nat. Hist.*, 1867; Tschudi as S. tricolor, in *Fauna Peruana*. Other synonyms are recorded. It is a larger form; body eleven inches long; tail to end of hairs thirteen and a quarter inches in length. The pelage is short, harsh, and sparse. The ears are long and narrow, the tail very full and bushy. Above, the color is black, varied with fulvous, or red; beneath, it is abruptly paler, of a yellowish-white. Occasionally the whole animal is black. This species is distinguished by its large size and long narrow ears.

DOUBTFUL SPECIES.

Under the above head Mr. Allen considers some forms that have been named by foreign authors, and have not yet been clearly recognized. *Sciurus nebouxi*, Is. Geoff., was obtained in Peru by Dr. Néboux, for whom it is named. Geoffroy gives a colored figure of it in the *Voyage of the Venus*. It measured $10\frac{60}{100}$ inches. Although this species seems quite different from any other described, Mr. Allen says, "It may, however, be merely a gray phase of some other well-known species, possibly of S. hypopyrrhus."

Sciurus dimidiatus, Waterhouse, named by Gray, Macroxus, was described by Waterhouse as a South American species. Some doubt is expressed about its American origin.

Sciurus bottæ, Lesson.—This is said to have come from California.

Sciurus clarkei, Ham. Smith, called Spermophilus clarkei by some authors. This was figured by Hamilton Smith from a specimen in Peale's Old Museum, Philadelphia, which was said to have been brought home from the West by Lewis and Clark, the Missouri explorers. It does not agree with any known American Sciurus. Authors consider it a doubtful American form.

Sciurus socialis, Wagner, is a species described by Wagner, in 1837, from two specimens brought from Mexico. They were at first named S. albipes, afterwards S. varius, then they were called by the present name.

TAMIAS.—*Illiger.*

The characters of this genus are seen in the narrowed skull anteriorly, the long post-orbital processes, which are slender and directed downward and backward. The malar bone has a more oblique plane, and the zygomatic process of the maxillary is more expanded and depressed than in Sciurus, but rather less so than in Spermophilus. The anti-orbital foramen is oval, and situated in the base of the zygomatic process of the maxillary. The upper premolars are two or one; when two are present the first is generally minute. Ears of medium size or small, well clothed, but never tufted. The cheek pouches are large. The pollex has a well-developed nail. The tail is shorter than the body, flattened and rather broad, shorter and much narrower than in Sciurus. The pelage is full generally, and soft. The dorsal surface has two and sometimes four longitudinal stripes bordered on each side. Tamias resembles strongly Spermophilus, the more noticeable differences being: In Tamias there is occasionally only a single upper premolar, and when two are present the first is generally minute, but little larger than those of S. hudsonius. In Spermophilus two are always present, and the first is functionally developed, being from one fourth to one half the size of the second. In Tamias the whole dentition is weaker, and the teeth relatively smaller. The anti-orbital foramen is sometimes quite narrow, and the outer and lower border is not generally developed into a projecting bony rim, culminating in a tubercle, as in Spermophilus. The tail is usually more flattened, and the general form is more Sciurine. The skull is more delicate, also.

As above defined, according to Mr. Allen's synopsis, Tamias has four species. All are represented in North America; three of them are not found elsewhere; the fourth, T. asiaticus, ranges over the western portion of North America and a large portion of Northern Europe and Asia.

THE STRIPED SQUIRREL (*Tamias striatus, Linn., Baird*) is the Sciurus striatus of Linnæus. No other animal is more familiar to the country-side than this cheery little Chipmuck, Chipping, or Ground Squirrel, as it is variously termed. Hackey is another name, known more in the Middle States. Old stone walls seem to be the favorite resort of this little creature, and every country boy finds such localities most certain to yield ready game to his box-trap. The length of this species is five and three-quarter inches; the tail to end of the hairs four and a quarter inches. This creature is too well known for us to add more descriptive matter. Its coloration is very constant. Mr. Allen says: "The variation in about a hundred skins of New England specimens consists merely in a more or less grayer cast of the upper surface in some than in others, in the sides being more strongly yellowish, and the rump of a darker or lighter shade of chestnut. The stripes vary somewhat in width and purity of color." The Striped Squirrel inhabits from Minnesota to the Atlantic, and from Canada to Georgia. It is not found in the "alluvial districts of Carolina," nor in Florida.

NORTHERN CHIPMUCK (*T. borealis, Gmelin, Allen*).—This is T. quadrivittatus of Aud. and Bach., and T. pallasi, Baird. The variety borealis has a length of five and a half inches; the tail to end of hairs is five inches. The color above is a pale yellowish-gray, with a faint wash of brownish fulvous on the sides; the back has five black lines, which alternate with four lines of yellowish-gray, all being nearly equal in breadth, and somewhat sharply defined. It is grayish-white beneath. The sides of the head have two narrow lines of grayish-white, extending from the nose to the ear, a brownish-black stripe intervening; a narrow blackish-brown stripe is above

the light ones, and another below them. The middle black stripe extends from the occiput to the base of the tail. The habitat is North-eastern Europe, Northern Asia and North-western North America, southward nearly to the United States. As it is found more southward it merges into the variety quadrivittatus, the ROCKY MOUNTAIN CHIPMUCK. The length of this is four and a half to five inches. Its range is from the middle and southern portions of the Rocky Mountains to New Mexico. The variety pallidus, the PALE CHIPMUCK, is smaller and paler than the preceding. Its length is four and a quarter inches; the tail to end of hairs four inches. It is common on the dry plains of the Upper Missouri and Yellowstone, and the desert plains of the Great Basin. Variety townsendi is larger, the length being $5\frac{30}{100}$ inches. It inhabits the Pacific Coast from Northern California to British Columbia. Variety dorsalis, the GILA CHIPMUCK, is of medium size, and is found in the Gila region, Arizona.

HARRIS' CHIPMUCK (*T. harrisi, Aud. and Bach., Allen*).—This species is five inches in length. It was obtained originally in Oregon, and is now found in New Mexico and California. It is regarded as a desert animal, differing from others of the genus, which are inhabitants of the woodland.

SAY'S CHIPMUCK (*T. lateralis, Say, Allen*).—Audubon and Bachman describe this as Spermophilus. Its length is seven and a quarter inches, being the largest of the genus. It is said to vary greatly in color, even among specimens from the same locality. It was first described by Say, in 1823, from specimens from the Arkansas River. Its habits closely resemble those of the Eastern Chipmuck.

SPERMOPHILUS.—*F. Cuvier.*

The skull in Spermophilus is very variable in its form; it is either narrow and elongate, or short and broad, with the dorsal line moderately or strongly convex, and the zygomatic arches greatly or only moderately expanded. The cheek pouches are well developed. The ears are never tufted. The nail of the pollex is generally undeveloped. The genus includes a group of quite dissimilar forms, some resembling the Squirrels, others Cynomys, and some have a look of Tamias. It is considered impossible to subdivide the American forms of this genus into sharply-defined groups, yet they admit of being separated into three sections, as above indicated. The Spermophiles are confined nearly to the colder portions of the country, and they are equally represented in northern portions of both the Old and New World. In North America none occur east of the plains and prairies; they range westward to the Pacific Coast, and southward as far as the plains of Northern Mexico. All of the known species, except one, have representatives within the United States, this being S. annulatus, known as yet from a single specimen only, from Western Mexico. Several species are remarkable as being carnivorous to a certain extent, or having carnivorous propensities. Specimens have been seen to devour Mice and small Squirrels. Mr. Kennicott records that the farmers have complained that the Gray Spermophile destroys their young chickens. The term Spermophile indicates their seed-eating propensity.

LINE-TAILED SPERMOPHILE (*Spermophilus grammurus, Say, Bach.*)—This is very distinct from any other species of the genus. It is noted for its wide, full and bushy tail, and large and pointed ears, also for its general Squirrel-like form. Its color and size is different, excepting in the species S. empetra, which is its nearest "affine." Mr. Say brought this from the headwaters of the Arkansas River in 1823. Several varieties are noticed, called S. beecheyi and S. douglassi. The popular name is GROUND SQUIRREL. The length of this species is about twelve inches; the tail to the end of the hairs is nine inches. The color above is a mottled white and black, or grayish, The tail is white and black, in alternating bands, longitudinally arranged, two black and three white. Its habitat is Colorado, southward to Mexico, and westward to the Sierra Nevada.

PARRY'S SPERMOPHILE (*S. empetra, Pall., Allen*).—This is the QUEBEC MARMOT of Foster and Pennant, and S. parryi of Baird. There are three varieties, called respectively kodiacensis, erethrogluteus and empetra, as above. It is about the size of S. grammurus, or rather larger, its length ranging from twelve to fourteen inches; the tail from end of the hairs is four and a half inches. The color of this species is a mixed yellowish-brown, white and black, the white appearing in square-like blotches. Richardson says: "This Spermophile inhabits the barren grounds skirting the sea coast from Hudson's Bay, round by Melville Peninsula, to Behring's Straits."

RICHARDSON'S SPERMOPHILE (*S. richardsoni, Sabine, Rich.*)—Two varieties are seen. S. townsendi (one of them) was described by Audubon and Bachman as a separate species. It is also recorded as such by Baird. The S. richardsoni is seven to nine and a half inches in length. The general color is yellowish-brown above. The ears are small and pointed. The tail is short and flattened, more or less bushy, occasionally terete. This variety is larger than the other. The species is found as far east as the Pembina Mountains, and extends westward as far as the Rocky Mountains. Its southern extreme is near the Laramie Plains.

THE SHORT-TAILED SPERMOPHILE (*S. mollis, Kennicott*) is described by the author of the specific name in *Proc. Acad. Nat. Sci., Phil.*. 1863. It was procured in Utah. Other specimens have been found in Nevada. In coloration it resembles S. mollis and several other forms. The ears are so small that little is seen of them. The muzzle is very much compressed; the tail very short and flattened. The pelage is soft and furry. Its length is six to six and a half inches; the tail to end of hairs two and a half inches.

FORT YUMA SPERMOPHILE (*S. tereticaudus, Baird*).—This is described by Prof. Baird in *Mam. N. A.* Its length is about six inches; tail to end of hairs four and three-quarter inches. Its color is a yellowish-brown and gray above. The ears are nearly

obsolete; the tail slender and rounded, as indicated by its specific name. As yet only three specimens are known to science; those are the ones described by Prof. Baird, in 1857, which were brought from Fort Yuma by Gen. G. H. Thomas.

SONORAN SPERMOPHILE (*S. spilosoma, Bennet*).—This species was found by Mr. Bennet in "that part of California which joins Mexico." Audubon and Bachman describe it as S. mexicanus. Its length is six and a half to seven inches. It is rare in collections, though it is said to be abundant in the region of the Gulf of California, and as far east as El Paso, and northward to Fort Stanton.

KENNICOTT'S SPERMOPHILE (*S. obsoletus, Kennicott*).—This is closely allied to the preceding, its form and size being the same. Its color is a dull yellowish-brown, indistinctly spotted with lighter, the spots being bordered with black posteriorly. The ears are nearly obsolete. The tail is terete near its base, and broad and tufted at the end. Its habitat is in Utah and the neighboring region.

THE MEXICAN SPERMOPHILE (*S. mexicanus, Licht., Wagner*).—This form was first found in Mexico, but is now known on the Texan side of the Rio Grande. Its size is eight to eight and a half inches in length; tail to end of hairs five and three-quarter inches. The color is similar to others, "with numerous lines of subquadrate spots of white." The ears are small, but distinct. The pelage is coarse and stiff.

STRIPED SPERMOPHILE (*S. tridecemlineatus, (Mitchell) Aud. and Bach.*)—This species is met with as far east as Minnesota, and it extends westward to the Rocky Mountains, and southward to Missouri and Western Texas. Latterly it is seen as far east as Northern Ohio. Two varieties are known—one called pallidus, rather smaller. "In the pattern of coloration this quite strongly resembles the S. mexicanus. The latter is smaller, and has a longer tail; it also differs in some characters of skull."

FRANKLIN'S SPERMOPHILE (*S. franklini, Sabine, Lesson*).—This is also called the GRAY-HEADED SPERMOPHILE. It is about ten inches in length; the tail to end of hairs six and a quarter to eight and a half inches. No species is so strongly marked as this, and, consequently, it is not confounded with any other. It seems to have been quite unknown to Audubon and Bachman, though quite common in Illinois and Wisconsin. Mr. Jillson, formerly of Lynn, Mass., and now of Tuckerton, N. J., has communicated to Mr. Allen's *Monograph on Rodentia* some very interesting facts concerning its introduction into Tuckerton, in the State of New Jersey. He says that a single pair were introduced there in 1867, when they escaped. The same species, in considerable numbers, are now found nine miles from that place, and also four miles south of the same. "They are very common on all the farms in Tuckerton, and seem always to keep in the fields, as I have never seen them in the woods. I find very little dirt at the mouths of their burrows, sometimes none. They destroy young chickens and turkeys." They are called Gophers in that region. It is a remarkable circumstance that in ten years the offspring of one pair of these animals should spread over so large a tract.

ANNULATED-TAILED SPERMOPHILE (*S. annulatus, Aud. and Bach.*)—This species was first described by Audubon and Bachman, in 1842. It is a Mexican form, and rather rare. The general form is very much like the Squirrels. The ears are broad, fully a half an inch high, and rounded above. The tail is nearly the length of the body, including the hairs. The length of the body is nine and a half inches.

CYNOMYS.—*Raf.*

This genus, like the preceding, has been variously named: as Arctomys, Spermophilus, Anisonyx, etc. The generic characters are seen in the "rather short skull, which is broad, highly arched and massive. The upper premolars are two, the first large. The dentition is heavy. The grinding-teeth, except the first premolar and last molar, have the transverse breadth twice the antero-posterior. The last molar is much larger than the others. The cheek pouches are of moderate size. The tail is very short and flattened; the ears rudimentary; the pollex large, with a well-developed nail; the pelage short, full and soft; the coloration without spots or streaks." This genus is especially characterized by the massive dentition; there is also a remarkable convergence of the upper molars. It is represented by only two species; those are confined to the parks and plains of the great mountain plateaux.

THE PRAIRIE DOG (*Cynomys ludovicianus, (Ord) Baird*).—Plate II, fig. vii.—Called also the MISSOURI BARKING SQUIRREL. Godman calls it the Prairie Marmot; Richardson the Wistonwish; and Say the Louisiana Marmot. The length of this creature is about twelve inches, with a tail about five inches, including the hairs. Lewis and Clark first met with it on the banks of the Missouri River, in 1804. The eastern limit of its range is near the ninety-eighth parallel. The Prairie Dog is an interesting pet, as it readily becomes domesticated. Specimens are kept at the Central Park Gardens, New York, where they amuse greatly by their curious habits. Though called Barking Squirrel, it nevertheless does not bark, but emits a true sciurine voice. It is also far from being dog-like. It does not inhabit, willingly, the same burrow with the Rattle-snake and Owl, as is so commonly believed; the latter simply chance to occupy the deserted holes of the "Dogs."

THE WESTERN PRAIRIE DOG (*C. columbianus, (Ord) Allen*) is the Arctomys lewisi of Audubon and Bachman, and SHORT-TAILED PRAIRIE DOG of Baird. The length of this form ranges from nine and a half to eleven and a half inches. The tail is very short and flattened, usually a pure white. This is a smaller animal than the preceding, with the tail about one half the length of the same in that species. It is confined to the region west of the Rocky Mountains. Like the other species, it lives in large companies, sometimes two hundred acres being populated by them. Each burrow has ten or twelve occupants. The earth thrown up from the excavations form

elevations upon which they are wont to sit as sentinels to warn the community of approaching danger. In the event of danger, they emit a shrill whistling noise somewhat like *tweet! tweet! tweet!* Their food consists of the roots of grass, etc.

ARCTOMYS.—*Schreber.*

This genus has rather small grinding-teeth. The size of the animal is large compared to others; the body thick-set, broad and depressed. The cheek pouches are small; tail rather short and bushy. The ears are small. The nail of the pollex is either broad and flat, or wanting. The pelage is coarse, with thick under fur. Animals of this group are found throughout the northern and middle portions of the northern hemisphere, and not elsewhere.

THE WOODCHUCK (*Arctomys monax, Linn., Schreber*).—Plate I, fig. iv.—The generic term indicates Bear-mouse, probably from the massive nature of the skulls in this group. The length of this creature is about fourteen inches. Its habitat extends from the Carolinas northward to Hudson's Bay, and westward from the Atlantic Coast to Western Missouri, Iowa and Minnesota. The specific name monax was first given by Linnæus in describing the "Monax or Marmotte of America." In the Atlantic States it is called Ground Hog, or Woodchuck. This creature is very common in the country-side, yet few really know it, its habits being rather crepuscular. It selects the under side of some large boulder, or the stump of a large tree, where it constructs a deep burrow. It is said to be social in its habits, several animals burrowing near each other. "We noticed thirty or forty burrows in one field."—*DeKay.* It brings forth four or five at a litter. The burrow is said to contain large excavations, in which the animal stores its provisions. It hybernates in the colder season, after carefully closing the entrance to its burrow. The Woodchuck is said to be common in the mountainous districts of the Carolinas, but is not known on the sea-shore.

ROCKY MOUNTAIN MARMOT (*Arctomys flaviventer, Aud. and Bach.*)—This species was first described by Audubon and Bachman, in 1841, from a specimen brought from the mountains of California, near Texas. Its northern range is probably about the forty-ninth parallel. It is seemingly a strictly Alpine species, and is gregarious in habit, like the European Marmot. Its size is considerably more than that of the Woodchuck, measuring in some instances eighteen and a half inches. The tail to the end of the hairs measures nearly ten inches. The color is, above, a mixed gray, fulvous and reddish-brown; below, it is yellowish or golden, varying to rufous. The ears are rather small. The tail is long, round, full and bushy. Melanistic specimens are quite common. Mr. Allen says: "At Montgomery, Colorado, where this species occurs in great abundance, and where I have seen a dozen or more sitting on the rocks at one time within easy rifle-shot, generally several black ones were to be seen associated with the others, as well as others more or less blackish." The principal difference in the two species is the larger size of the present one; its smaller ears and longer tail are also marked in comparison. The color of this Marmot is sometimes a rich golden upon the upper surfaces. There are also some differences in the cranium.

THE HOARY MARMOT (*Arctomys pruinosus, Gmelin*).—This is also called the WHISTLER. The extreme size of this species, and its entirely different coloration, renders it readily distinguished. The European Marmot resembles it more closely in size and color than any other. The rudimentary thumb, which is present in all American species, is wanting in the European. Pennant first described the Hoary Marmot in 1781, from a specimen taken in Hudson's Bay. It is said to extend north to the Arctic Circle, the Columbia River being its southern limit. Its length is from twenty-three to twenty-five inches, the tail being nearly half as long. Its color is a clear grayish-white, varied with black. The ears are quite small, well clothed, and nearly concealed by the surrounding pelage. The tail is full and round.

FAMILY—HAPLODONTIDÆ.

This is a very peculiar group or family, founded upon the existence of a single species of Rodent, called by the natives *Sewellel.* The teeth are: Incisors, $\frac{1}{1}-\frac{1}{1}$; Premolars, $\frac{2}{1}-\frac{2}{1}$; Molars, $\frac{3}{3}-\frac{3}{3}$. All are rootless, prismatic in shape, and simple. The clavicles are perfect. An interesting and thorough report of the family characteristics are recorded by Dr. Coues, in his Monograph, which forms one of the series in Dr. Hayden's *Report on the Rodentia*, 1877. Dr. Coues says: "The general tendency has been of late years to associate Haplodon more or less intimately with Castor, and to refer both to the Sciurine series, if not to the *Sciuridæ* itself." The skull, he remarks, is strongly and unmistakably sciuromorphic. In its habits, too, there is a resemblance.

HAPLODON.—*Rich.*

This genus has been variously named, as: Aplodontia, Apluodontia, Haploodon, etc. The present term has reference to its simple teeth. Its characters are seen in its stout and heavy form, its cylindrical body, short limbs, the broad and flat head, the short terete and hirsute tail, the very long and bristly whiskers, the absence of cheek pouches, the diminutive eyes and long bristly hair, with woolly under fur. In progression it is plantigrade. In habit it is fossorial and gregarious. Its voice is shrill, and its food is entirely of vegetable matter.

THE SEWELLEL (*Haplodon rufus, Raf., Coues*).—This interesting animal was first discovered in 1805, by the famous travelers, Lewis and Clark, in the country near the mouth of the Columbia River. The present name is that which the natives gave it. The Indians make great use of the skins, which they dress with the fur on, and fasten together with sinews of the Elk and Deer. It mounts a tree and burrows in the ground precisely like a Squirrel. Dr. Newberry says of it: "This remarkable animal seems limited to a narrow district when compared with

most of those which, with it, inhabit the region it occupies. In Washington Territory it is found from the coast to the Rocky Mountains." It is doubtful whether it is found south of the Columbia River, although it is reported from California. Very little is known of its habits. According to certain few observations it is not an hibernating animal. Mr. Geo. Gibbs, the ethnographer, says of it: "Its name in the Nisqually language is Showt'l (*Showhurll*). It burrows extensively in the ground. Near their abodes were small bundles of some herb or plant, cut with nicety, and laid out on logs to dry or wilt. The Indians trap them, and value their flesh very much as food." If this habit of cutting food in parcels for future use is theirs truly, it is exceedingly curious. The Yakima Indians call the animal *Squallah*. Mr. Gibbs says that the statement that it climbs trees is probably an error. It lives in communities, like the Prairie Dog, sitting upon the mounds at the burrows and whistling as those little creatures do in the early morning. Dr. Suckley says: "It is probable that it has several litters of young in a season. The Sewellel is about as large as the Musk-rat, and is said to somewhat resemble that Rodent. Its color is brownish, mixed with black, lighter and more grayish below."

FAMILY—CASTORIDÆ.

There are many points of resemblance between this family and the *Sciuridæ*. There is but one genus representing the living species. The molars in this family have a long, persistent pulp, the teeth continuing to grow for a long time, and only becoming truly rooted late in life. The incisors are very large, the Beavers being the typical gnawers. The general structure of the skull indicates great incisive power.

CASTOR.—*Linn.*

The characters are seen in the four-toed feet, the palmate hind-feet, the double-clawed second toe, the broad, flat and scaly tail, and in the broad and heavy body, which is most powerfully developed posteriorly. The molars are $\frac{4}{4}$–$\frac{4}{4}$, single-rooted, the pulp being persistent until late in life. The skull lacks the post-orbital processes; otherwise it has the general form of *Sciuridæ*.

THE BEAVER (*Castor fiber, Linn.*)—Plate 15, fig. 50.—One species only is known, yet two well-marked varieties are noticed, one inhabiting North America, and the other Europe and Western Asia. The American form is regarded as rather larger than the other. Some difference is seen in the nasal bones, and some less important features are said to vary in the two. The European Beaver does not perform the work of building dams and houses to that extent seen in the case of the American animal. The Beaver is the largest Rodent living, with the one exception, the Capybara, of South America, which is about a third larger. The color is a rich reddish-brown. Black varieties are sometimes seen, and albinos are not rare. When full-grown, the Beaver weighs from thirty to sixty pounds. A specimen, which weighed fifty-eight pounds, measured over four feet from nose to end of tail. The form is so short that he runs with difficulty. He walks with a waddling gait, his body barely clearing the ground, and his tail dragging. In the water he is at ease, and his movements rapid. While swimming, he uses the hind-legs exclusively, the fore-paws being drawn up under the chest. He is a burrowing animal; deep excavations are made in the banks of streams, where he may retreat for safety, preferring this to the "lodges," which are constructed above water for the purpose of rearing the young. The female brings forth her litter early in May, from two to five at a birth. The habitat is remarkably extended: from the borders of the Arctic Seas to Mexico and the Gila River, and from the Atlantic to the Pacific. Beavers are now seldom found east of the Mississippi River; occasionally one is captured in Maine, New York and Virginia. In some portions of Canada and in California they are yet numerous. There are marked differences in the habits of the two varieties. The European Beaver is said to lead a solitary life in burrows, rarely constructing dams, while the American form is notably a skilful builder of dams and lodges, as well as burrows. Canals of remarkable construction and purpose are also the work of this interesting creature. The European animal was once abundant in the region around the Black Sea during the Classical Period. Pliny calls it the "Pontic Beaver." He gives a brief account of its habit of cutting down trees, but does not mention any instance of dam building, though a few examples are known. It is a remarkable fact that the reputed sagacity and intelligence of the Beaver is not explained by the size or development of brain. This organ is but a step in advance of that of the bird, as the Beaver is a monotrematous animal, that is: it has but one opening at the anal region, which indicates a low rank among Mammals. The great commissure, or *corpus callosum*, is absent in the brain. The brain is, also, entirely smooth on the surface. The Beaver is noted for a peculiar secretion, called castoreum, which has long been reputed as a medicine. It has two sets of secreting organs situated in the anal region, the upper pair furnishing the castoreum, and the lower an oily secretion. A remarkable provision against the possible harm resulting from too long immersion in water, is seen in an enlarged portion of the great vein, or *vena cava*, where it passes through the liver. As in birds, this receives an extra supply of blood, which serves when respiration is temporarily suspended, as while passing under water to its various works. Mr. Lewis H. Morgan, in a very complete and exhaustive treatise, *The American Beaver and his Works*, has given most entertaining accounts of the dams, canals and other works of this animal, from which we take certain facts. Around the south-west shores of Lake Superior, Mr. Morgan, in his profession as civil-engineer, had most unusual opportunities of viewing and watching the skill of the Beaver. Through this entire area the Beavers are now abundant, and undisturbed in their works. The dam, called by the natives

oko-min. is the principal work, its object being to furnish an artificial pond, which shall render the water sufficiently and evenly deep as to protect the entrances to their lodges and burrows, which are partially submerged. This self-imposed task, seemingly, of building dams is one of the most astonishing things in connection with animal "instinct," sagacity, or intelligence. The animal naturally builds a burrow, as any other, in which to rear the young, or retreat for protection. Besides this, we see him exercising the ingenuity of an engineer in constructing a house with a submerged cellar, through which he reaches a close chamber, the integrity of which is dependent upon a steady level of the surrounding water; the water must be above the entrance, but below the floor. Does he anticipate the possibilities, or has he experienced a flood and its discomforts in his well-built home? One thing is true: he constructs, through immense labor, a dam which causes a stay of the water, and, by constant care and prompt repairing, the needed condition is fulfilled. His house, or lodge, is a sort of edifice for ordinary purposes, while the burrow is a more natural means of protection. On the small grass islands that are seen in Beaver Meadows these houses are constructed; they consist of immense piles of sticks and mud, formed into a dome-shaped hut. One measured by Mr. Morgan was sixteen feet in diameter at the water-line. The vertical height of the lodge from water level was four feet six inches. This lodge was opened by Mr. Morgan, who found about one foot in thickness of the top "substantially solid." The ground-plan showed a chamber seven feet and eight inches in length, and seven feet in breadth. The vertical height was a little over twelve inches. An entrance issuing from the pond was ten feet in length, another side entrance being seven feet in length. The roof was about three feet, and the side walls nearly five feet thick. "Among the characteristics of the Beaver," says Mr. Morgan, "is that of cleanliness, and nothing appeared in this chamber to detract from his reputation in this respect. There was no opening for light or ventilation; but yet, from the porous nature of the materials, as put together, sufficient air would penetrate the lodge from without to satisfy the requirements of its occupants, whose low respiration enables them to endure the confined atmosphere of the lodge and burrow. Their breath in the winter season, rising through the top of the lodge, dissolves the snow, thereby exposing their habitation to the trapper." The entrances, usually two, are the most remarkable parts of the edifice, being constructed very skilfully, and even artistically. Two kinds are seen: one is straight, or as nearly so as possible, the floor being an inclined plane, rising gradually from the bottom of the pond to the chamber; the other is abrupt in its inclination, and sinuous in its course. Mr. Morgan regards the first as a "wood entrance," from its evident design to facilitate the admission of "wood cuttings," upon which they subsist during the winter. The other entrance is for ordinary passage. These passages were rudely arched over with a roof of interlaced sticks, filled in with mud, intermixed with vegetable fibre, and were extended to the bottom of the pond and trench, with the exception of the openings at their ends. Where they joined the floor, they were constructed with neatness and precision, "the upper parts and sides forming an arch more or less regular, while the bottom and floor edges were formed with firm and compacted earth, in which small sticks were embedded. It is difficult to realize the artistic appearance of some of these entrances without actual inspection." The quantity of sticks used in the construction of this lodge was about a cord. In most instances the floor of the lodge is from two to six inches above the water. It is evident that some calculation is exercised to maintain a proper water level, as the "cuttings" which they *prepare* for food have to be carried by the Beavers down to the bottom of the pond, and thence up the inclined plane to the entrance. Here they must drag the "cuttings" by the teeth up and into the lodge, depositing them upon the floor. Now, if there is great discrepancy in the elements of structure, the Beavers may find it a difficult feat to lift the "cuttings" by the teeth after they are out of water; while immersed, the buoyancy is greatly in their favor. "It is evident that the Beavers regulate the discharge of surplus water through their dams with a view to the maintenance, as nearly as possible, of a uniform level of the pond; and great variation would either flood their habitations or expose their entrances. * * * In all this, decisive evidence seems to be furnished of their possession of a *free intelligence*, as well as of constructive skill." There is usually a moat or ditch, about three feet wide, excavated around the lodge, opening on one side into the pond. The number of lodges in a large pond seldom exceeds four. The stories about lodges containing several rooms for special purposes are not true. Mr. Morgan regards the specimens of lodges that are double as the work of numerous individuals, and not by one pair. Moreover, these double houses do not communicate with each other, the rooms being entirely separate. The burrows are small underground chambers, usually constructed under the root of a tree, or entered from under a rock, and extend about fifteen feet into the bank of the stream or pond. They are used, seemingly, exclusively for temporary protection, the entrance being under water, and, no external mark being visible, they furnish a surer hiding-place than the lodge, which is very conspicuous. Dr. Newberry, speaking of the Beaver lodges and burrows, says: "The sides of the stream [in Oregon and California] are lined with their habitations. We found the Beavers in numbers, of which, when applied to Beavers, I had no conception." One of the most remarkable feats, or instances of engineering skill, performed by the Beaver, will be considered when we have examined the nature of the food which it depends upon, and the conditions required for its possession. The Beaver is exclusively a vegetable eater, and subsists mostly upon the bark of deciduous trees, not upon that of the pines and other evergreens that grow in the low-grounds. It prefers birch

cottonwood, poplar, etc. In the summer it eats the roots of the pond-lily and other plants that grow in the water-side. As Beavers do not hibernate, they are compelled to provide a store of provisions for the winter, during which their ponds are frozen over, when they are shut in and unable to pass out to procure food. In the month of September they commence preparing for the cold season. They repair their dams, and cut down trees to prepare their "chips" for future eating. All this work is performed at night. Observers have failed to get sight of them while engaged, although they have been seen at early morning in some few instances. The wood-cuttings which they prepare are deposited by some unknown process upon the bottom, "how, is a question;" says Mr. Morgan, "the yellow birch is about the same specific gravity of water." It is probable that when soaked the wood remains immersed. When the animal is frozen in, it is essential to his comfort that he have free access to his *wood-pile*, or store of provisions, which are deposited near the lodge, but upon the bottom of the pond. Now "when they leave their normal mode of life in the banks of rivers, and undertake to live in dependence upon artificial ponds of their own formation, they are compelled to forecast the consequences of their acts at the peril of their lives." They have, therefore, to build their dams sufficiently high so as to secure a depth of water that will not entirely freeze: there should be space left for unobstructed passage to and from the "commissary." It will readily be asked: How will this condition be sustained in the extreme cold regions, where a considerable depth of water freezes? One cause will be seen in the heavy body of snow that usually covers the ice-bound ponds of these regions; yet that quite shallow ponds remain open is well known, and trappers assert that over the Beaver-cuttings that have been deposited for winter use, the ice is usually thin. The ponds are rarely over six feet deep. Some local cause may affect the temperature of ponds, and of this the "astute" creature may have cognizance. A remarkable act of intelligence is now to be considered, which follows upon the necessities incident to the "chopping" and storing the "wood-cuttings," which are the preferred subsistence of the Beaver. Mr. Morgan gives a detailed and most interesting account of the discovery of a system of canals, whereby the Beaver is enabled to convey materials for food a considerable distance by water, thus facilitating a tedious and, in many instances, nearly impracticable process of gathering a winter's store. In some cases the dam accomplishes the requisite purpose, as well as to furnish sufficient water for concealment of the burrows and openings to the lodges. It causes the water to flow back in such volume as to bring large deciduous (and desirable) trees within reach by water, or so near that the "cuttings" may be rolled into it with little labor. Sometimes the coveted woodland is removed too far from the water for this purpose; in this event, a canal is cut to the nearest point, and in such dimensions as to admit of the conveyance of the cuttings and logs by water direct to the lodge. In one instance, one of these canals had several dams constructed across it for the purpose of flooding a still larger surface. This canal was 449 feet in length, and about three feet in width and two and a half in depth, and was cut entirely by the Beavers; the bottom revealing great numbers of roots, some very large, which had been cut across in the progress of the work. In some cases the canal was carried around the foot of the rising ground in two branches, thus securing a frontage of greater extent. Here was a necessity: no wood suitable for their purpose, either for building or for food, could be obtained easily. The ground was surveyed, we may safely assume, and a simple solution of the matter was accomplished. Just such a channel as we should expect was cut, up to the nearest point that water would flow to, and then the work was carried on in proportion to their wants. Trees were felled and cut in pieces, and rolled down the hill into the channel; once there, it was an easy matter to push the logs before them, as is their custom, swimming with them to the place of deposit. It is said that they hug the pieces, when not too large, to their chest, and, as they do not ever swim with the fore-paws, they easily progress with the loads. On land, these loads would be nearly out of their power to manage. The nearest point, in the above example, where the proper wood could be obtained was five hundred feet. Mr. Morgan has contributed most valuable specimens of the work of Beavers, as well as a vast amount of interesting knowledge that had not previously been known as reliable. He has preserved and sent to the American Museum, in Central Park, N. Y., two trunks of trees which show the work of Beavers. One is a yellow birch from Lake Flora, near Lake Superior, which measures thirteen and a half inches in diameter. This is cut so nearly in two that the tree had fallen by its weight to one side, this side being much more cut than the other. The slender portion remaining is broken in splinters, and would probably have soon yielded to the sharp incisors of the animal, had it not been taken away. Another tree, of the same dimensions, shows an even gnawing about half through the diameter. A fine specimen of Beaver, with small cuttings of the size usually secured for eating, is in the collection, from the same source.

We have given considerable space to this one species of Rodent, but the subject is one of exceeding interest. The marvelous execution of certain devices strike us as something beyond any other example. Although we meet at every hand most wondrous developments, we have the more willingly enlarged upon this theme for the purpose of giving what is now known to be the truth concerning this animal. As in the case of many another living creature, absurd errors have been perpetuated in books of Natural History. Old stories from the classical writers, as well as of those more recent, have come to us from the various publications of the day. In the present account there is enough of the marvelous, and yet it is truth. The stories of

the Beaver carrying its loads upon the tail, and of its using the tail as a trowel, etc., are untrue. The tail is, no doubt, used to a certain extent to press the mud into place, and, from its broad surface, is very serviceable in swimming.

MYOMORPHA.—MURINE RODENTS.—MICE-LIKE ANIMALS.

FAMILY—MURIDÆ.

The Mice are represented by this family name. Mr. Allen, in his valuable Monograph of the series in Hayden's *Report on Rodentia*, 1877, says: "With the exclusion of Zapus, which, as a type of a separate family, will be treated in a separate memoir, the family *Muridæ* is represented in North America by only two sub-families, *Murinæ* and *Arvicolinæ*, out of the number of groups into which it is usually divided. As represented in North America, and by the two sub-families, the family *Muridæ* has the following characters: Incisors, $\frac{1}{1}-\frac{1}{1}$; Premolars, $\frac{0}{0}-\frac{0}{0}$; Molars, $\frac{3}{3}-\frac{3}{3}$; $=\frac{8}{8}=16$ teeth.

"The sub family *Murinæ* has rooted molars; and compressed incisors, narrower than deep. The root of the under incisor causes a protuberance on the outer side of the mandible, at or near the notch between the condylar and coronoid processes. The palate is nearly plane; the nasals projecting anteriorly."

"In *Arvicolinæ* the molars are normally rootless (except in Evotomys), prismatic, with flat crown and serrate periphery. The incisors are often broader than deep. The root of the incisor causes a protuberance, if any, on the inner side of the mandible, at or near notch between the condylar and descending process. The palate is highly arched. The nasals are not produced beyond the premaxillaries."

SUB-FAMILY—MURINÆ.

Mr. Allen makes two tribes, as follows: "*Mures* and *Sigmodontes*. This separation of the Old World (*Mures*) and New World (*Sigmodontes*) representatives of the sub-family, seems to us warranted, and not alone on geographical grounds; for a decided difference in dentition is found, serving for their immediate identification.

"*Mures*.—Molars of the upper jaw with the tubercles in three series. Palate extending back of the molars. (Palæogean.)" True Rats and Mice of the Old World.

"*Sigmodontes*.—Molars of the upper jaw with the tubercles in two series. Palate ending opposite the last molars. (Neogean.)" Rat-like animals of the New World.

"The *Mures* which occur in North America—namely, four species of the typical genus Mus—not being indigenous to this country, and being moreover among the best known of mammals, are not treated here."

TRIBE—SIGMODONTES.

All the *Murinæ* indigenous to America are included under this section.

NEOTOMA.—*Say and Ord.*

This genus embraces Sigmodont Rats of the largest size, their general aspect being highly murine. They are peculiar to North America.

WOOD RAT (*Neotoma floridana, Say and Ord*).—This is in color much like the Norway Rat. It is found in the Southern United States and Mexico. Specimens are found, also, in Massachusetts and the Middle States, and it is common in California.

DUSKY-FOOTED WOOD RAT (*N. fuscipes, Cooper*).—This is a California species, described by Dr. Cooper in 1857. It is regarded as unlike any other known form. A singular compression of the tail is noticed; its color, also, is singular, being very dark or black, and the feet are dusky.

FERRUGINOUS WOOD RAT (*N. ferruginea, Tomes*).—This is about seven and a half inches long, the tail being six and a half inches. Its color is a rich rusty-red, almost golden-rust color along the sides. The whiskers are very long, and jet black at base.

BUSHY-TAILED WOOD RAT (*N. cinerea*, (*Ord*) *Baird*).—This is rather the largest of the genus, being nearly eleven inches long. Its habitat is Western North America.

SIGMODON.—*Say and Ord.*

The general form of the animals comprising this genus is stout and like the *Arvicolinæ*. The pelage is hispid from the presence of stiff hairs. The ears are large and orbicular. The profile of the head is strongly convex; the muzzle short, obtuse and hairy, except the nasal pad.

COTTON RAT (*Sigmodon hispidus, Say and Ord*).—This is found in the Southern United States and Mexico, particularly on the coast region. Godman recorded it as Arvicola, Baird as S. berlandieri, and Aud. and Bach. as A. texiana. It varies from four to six inches in length. The length of tail is from $2\frac{2.5}{100}$ to $3\frac{9.0}{100}$ inches.

HESPEROMYS.—*Waterhouse.*

The classic term *Hesperia*, the "land of the west," is incorporated with a derivation from *Mus*, "a Mouse," and made to embrace certain forms of the New or Western World that are close representatives of the true Mus, or murine animals of the Old World. A sub-genus is instituted as follows:

SUB-GENUS—VESPERIMUS.—*Coues.*

Dr. Coues, from whose Monograph we extract the present matter (Hayden's *Report on Rodentia*, 1877), says: "We restrict our term *vesperimus* to *leucopus* and its immediate North American allies. As intimated before, it is exactly equivalent to Hesperomys of Baird, as limited by that author. * * * The only other name, except Hesperomys, that we can find has been applied to the present sub-genus, is *Museulus* of Rafinesque; that name, in strict technical conformity with the rules of nomenclature, ought to be adopted; * * * but the name is so inseparately connected with *Mus musculus* that to use it in a different connection, and one when the

tribal distinctions from Mus especially require to be signalized, would result in an evil of far more consequence than the breach of a rule of nomenclature." The sub-genus Vesperimus—the composition of the name probably referring to the crepuscular habits of the animal—is characterized by a size of body medium or small, and by its lithe form and quick movements. The eyes are large and prominent; the snout pointed. The ears are large, rounded, thin and sparsely set with hairs. The tail is terete, slender, closely hairy. The pelage is soft, close and glossy, with a few long bristly hairs. The skull is thin and papery, contrasting strongly with the *Arvicolinæ* in this respect. The dental structure is equally weak, and the habits of the creatures fully correspond, the diet being of softer substances.

WHITE-FOOTED OR DEER MOUSE (*Hesperomys* (*Vesperimus*) *leucopus*).—This little animal is called by Pennant, AMERICAN FIELD MOUSE; by Godman, Mus agrarius; by Baird, H. myoides and H. gambeli; by the latter, also, H. boylii, in *Proc. Acad. N. S., Phila.*, 1855; and by DeKay as Arvicola emmonsii. Numerous other synonyms are recorded; this is accounted for by the fact that a great variety is found throughout the extensive range of the species. Dr. Coues says: "It is curious to observe that almost every considerable geographical area within the limits" of its habitat, "produces a slight strain or breed of its White-footed Mice." * * * "We venture to assert that we can distinguish in North America about *twenty kinds of Hesperomys leucopus*, upon characters at least as constant, reliable and tangible, as those hitherto held to define the greater part of the 'species' that have been in vogue of late years." The habitat of this animal is throughout the northern portion of North America, as far as Puget's Sound, to California on the west, and Massachusetts on the east.

A species, or sub-species, called *H. leucopus gossipinus, Leconte*, inhabits the South Atlantic States. It is larger than the preceding, being about four inches in length, with a shorter tail. Another is called *H. leucopus sonoriensis, Leconte*. It is the Mus leucopus of Richardson, and H. nebrascensis of Baird. The tail is shorter than in the first-named. It inhabits the interior of North America, west of the Mississippi, and from the Arctic regions to Mexico. Another form is the *H. leucopus eremicus, Baird*—THE DESERT-MOUSE, from the Valley of the Gila, and Colorado. It is about as large as the first-named.

RED MOUSE; GOLDEN MOUSE (*H.* (*Vesp.*) *aureolus*, (*Aud. and Bach.*) *Wag.*)—This is like the preceding in size and shape, but different in color, "being a golden-cinnamon above, and yellowish-white or pale buff below." Found in the Central and Southern States. Baird records this as H. nuttalli.

THE MICHIGAN MOUSE (*H.* (*Vesp.*) *michiganensis*, (*Aud. and Bach.*) *Wag.*)—A very small species, rarely three inches in length; yellowish-brown above, with a broad dorsal stripe of sooty-brown; below, pure white. The feet are not entirely white. Habitat, Upper Mississippi Valley.

PARASITIC MOUSE (*H. californicus*, (*Gambel*) *Baird*).—This is about the size of a "half-grown House-rat, with extremely long ears and tail." Habitat, Southern and Lower California.

THE AZTEC MOUSE (*H.* (*Vesp.*) *aztecus, DeSaussure*).—A Mexican species, about three and three-quarter inches in length, the tail averaging over four inches.

BLACK-EYED MOUSE (*H.* (*Vesp.*) *melanophyrs, Coues*).—Has the "general aspect of a large species of the Hesperomys leucopus group." The ears are large and leafy; whiskers very long and conspicuous; length four inches; tail four and a half to five inches. Habitat, Southern Mexico.

SUB-GENUS—ONYCHOMYS.—*Baird.*

The skull in this genus is strictly as in the preceding, but with larger molars.

MISSOURI MOLE MOUSE (*Hesperomys* (*Onychomys*) *leucogaster, Max.*)—Maximilian procured this during his journey in North America, and the type is now owned by the American Museum, Central Park, N. Y. It is found in the Upper Missouri region.

ARIZONA MOLE MOUSE (*H.* (*Ony.*) *torridus, Coues*).—This form is from Arizona. It was described by Dr. Coues, in 1874, in *Proc. Acad. Nat. Sci., Phil.* It resembles the latter, with rather larger limbs.

SUB-GENUS—ORYZOMYS.—*Baird.*

This is characterized by having the superior margin of the orbit with a prominent sharp edge or bead. The anteorbital foramen is nearly circular above (resembling that in *Zapodidæ*), continued below as a slit much narrower than in Hesperomys proper. The hind-legs are short, but the feet are very long and large, as in Fiber. It exceeds in size any other known species of Hesperomys, and has the general appearance of Sigmodon or Mus. The species approach the true Mus of the Old World more closely than any other of our Rodents.

RICE-FIELD MOUSE (*Hesperomys* (*Oryzomys*) *palustris*, (*Harl.*) *Wagner*).—This is the *Arvicola orizivora* of Aud. and Bach., the specific term referring to its rice-eating propensities. The sub-genus is named from *oryza*, the Greek for Rice, *mys* being from the Latin *mus*, a Mouse. This species is especially well known in the Southern rice-fields, extending to the Gulf States.

REITHRODON.—*Waterhouse.*

Several species were included in this genus by Prof. Baird (*Mam. N. A.*), but, as now restricted, "the genus," says Dr. Coues, "appears to be confined to the southern part of South America, from which three species have been described. It may be recognized at once by the longitudinal grooving of the upper incisors, a feature not shared by any other South American Mice, as far as is known, and only again met with among American *Muridæ*, in the North American genus Ochetodon." The latter is in other respects, very unlike Reithrodon, which has a stout leporine form, of large size, and tail half as long as the trunk.

Reithrodon cumiculoides, Waterh., is the typical species, found in Patagonia. Its length is about six and a half inches, with tail three and a half inches.

Reithrodon typicus, Waterh, is from La Plata, and is about the same size.

Reithrodon chinchilloides, Waterh., is smaller. From the Straits of Magellan. All of these were brought away by Mr. Darwin, while attached to the English exploring ship "Beagle." Dr. Coues has established a sub-genus for the latter, which he denominates *Euneomys*.

OCHETODON.—*Coucs.*

Animals of this genus have the general resemblance to the true Mice, but have the characters of Hesperomys, excepting that the superior incisors are deeply grooved lengthwise; hence the name, *ochetos*, meaning canal. The tail is about as long as the head and body. The form is slender and mouse-like, and very small. The genus comprises some of the smallest mammals in America. They have a close general resemblance to ungrown House-mice. The teeth distinguish them readily, the molars having a peculiar aspect on the enamel loop, which resembles the Greek letter *sigma;* hence the name applied to the group—the *Sigmodont Murinæ*. The upper incisors are grooved in a peculiar manner, also. This feature is unique with the North American *Murinæ*. These grooves are longitudinal, and are so prominent that when the incisors are closed, a deep notch appears, giving four points, instead of two, upon the face of the teeth. The under incisors are simple. A number of marked peculiarities are also seen in the skull of this genus.

LITTLE HARVEST MOUSE (*Ochetodon humilis, (Aud. and Bach.) Coues*).—Much like the common House-mouse, but smaller. Inhabits the South Atlantic States, Sonora, and west to Nebraska. First described by Aud. and Bach, in 1841.

LONG-TAILED HARVEST MOUSE (*O. longicauda, (Baird) Coues*).—Habitat, California.

MEXICAN HARVEST MOUSE (*O. mexicanus, (DeS.) Coues*).—Larger than either the preceding. It is a Mexican species, but found as far north as Louisiana.

SUB-FAMILY—ARVICOLINÆ.

The characters are seen in the normally rootless molars (except in Evotomys), prismatic forms and flat crowns, the periphery being serrate. The incisors are often broader than deep. The palate is highly arched. The fore-teeth are large and broad in comparison with the compressed and small incisors of the *Murinæ*. The molars, also, are strongly contrasted, those of the present group being so much larger than those of the other.

EVOTOMYS.—*Coues.*

This is the same as Hypudæus of Baird. It is much like Arvicola proper, but has ears plainly visible above the fur. The molars are each two-rooted, the middle lower molar like the last one. The species are few in number. The North American may be recognized at once by their prominent ears, and tawny red color.

Evotomys rutilus. (Pall.) Coues.—Dr. Coues says of this species: "We have great pleasure in adding this interesting animal to our Fauna, our only previously-recorded form being the variety gapperi, and the *Mus rutilus* of Pallas being supposed to be confined to the north of Europe and Asia." Its habitat is given as "circumpolar regions of both hemispheres." Specimens have been found in Massachusetts, where it is not rare.

RED-BACKED MOUSE (*E. rutilus gapperi, (Vig.) Coues*).—This is a form that is but little removed from the preceding. The habitat is the northern frontier of the United States.

ARVICOLA.—*Lacépède.*

The molars are $\frac{3}{3}$–$\frac{3}{3}$, rootless, perennial and prismatic; the crowns divided into several closed islands of dentine by folds of the surrounding sheet of enamel, that meet from opposite sides and fuse along the medium line. The pelage is thick, soft, of ordinary fur, interspersed on the back with longer bristly hairs. The North American species are arranged in four groups, which are regarded as quite natural. The generic term is derived from *arvum*, a field, and *cola*, expressing habitation.

SUB-GENUS—MYONOMES.—*Raf.*

The teeth are concerned in this subdivision very considerably. The ear is unrimmed in front. The fore-claws are not longer than the hind ones; the tail about one third the head and body, or more. "This section is especially characteristic of North America, not being, perhaps, exactly matched in Europe and Asia. It embraces the greatest number of American species of the genus, among them the most widely distributed one of all, and includes, likewise, the largest one of all, while none of them are so small as our species of Chilotus, Pitymys or Evotomys." The peculiarities of dentition, as well as other generic characters, are of that nature that more space is required than we can give to the subject. We content ourselves, therefore, by making as valuable an abstract as our limits will allow.

COMMON AMERICAN-MEADOW MOUSE (*Arvicola (Myonomes) riparius, Ord*).—A long name for a small creature, but the specific one is appropriate, meaning a river-bank animal. A very large synonomy is attached to the great work of Drs. Coues and Allen, as applied to this species, many species being absorbed in the present. Dr. Coues says, after a very lengthy treatise on the subject: "In 1857, many names, all doubtless supposed by their several proposers to indicate valid species, were either formally or virtually suppressed; and a further reduction of eight is simply an advance, *pari passu*, with the increase of our knowledge on the subject. We trust we have proven the position we take, and that we have seen the last of nominal species based upon the endless variations of *Arvicola riparius*." This Mouse seems to be common in every part of North America, between the two oceans above Virginia.

TOWNSEND'S MEADOW MOUSE (*A.* (*Myonomes*) *townsendi, Bach.*)—This is a much larger species than the preceding, measuring five to six inches in length. The tail is longer in proportion; and the ears are also rather larger. The whiskers are about as long as the head. The soles of the feet, like those of riparius, have six tubercles. In color, it is nearly like the preceding. Some doubt is expressed about the validity of the species, and it may prove to be only a variety of the A. riparius.

A variety called *A. riparius*, variety *borealis, Richardson*, is the LITTLE NORTHERN MEADOW MOUSE, found in North-western America. It is a little smaller than the former, with smaller ears and feet, both being more hairy.

CHESTNUT-CHEEKED MEADOW MOUSE (*A.* (*Myo.*) *xanthognathus, Leach*).—Found in North America, north of the United States. "It is one of the largest of the American *Arvicolæ* we have ever handled. It measured six and a half inches long when fresh, and the skin indicates a stout bulky animal." The tail is shorter in proportion than in riparius. The specific name indicates "yellow-cheeked," but its color in the region of the cheeks is a bright bay or chestnut.

THE LARGE NORTHERN MEADOW MOUSE (*A. richardsoni, Aud. and Bach.*) is a variety recorded by Dr. Coues as doubtful. It is the same as appears in DeKay's *Report on the Mammals of New York.*

SUB-GENUS—CHILOTUS.—*Baird.*

This genus is characterized by very small form, with small and orbicular ears (hence the name, lip-eared—*Cheilos*, a lip, and *otus*, ear); the marginal portion, or helix, incurved all around. The surfaces of the ear are almost naked.

OREGON MEADOW MOUSE (*A.* (*Chilotus*) *oregonus, Bach.*)—This is said to resemble a half-grown A. riparius at first sight, but examination shows readily that it is adult. It is from the Pacific Coast.

SUB-GENUS—PEDOMYS.—*Baird.*

The ears in this sub-genus have not the inflected margin of the preceding, but are concealed. The plantar tubercles are only five.

PRAIRIE MEADOW MOUSE (*A.* (*Pedomys*) *austerus, LeConte.*)—This inhabits the Western States and adjoining territories, and south to Louisiana.

WESTERN PRAIRIE MOUSE (*A.* (*Pedomys*) *curtatus, Cope*).—This is found in the States west of the Mississippi. The tail is shorter than the head; color of the body a brownish-gray; size about four inches in length.

SUB-GENUS—PITYMYS.—*McMurt.*

This is below medium size. The body is cylindrical, and Shrew-like in various features. The tail is very short; the ears small and nearly concealed, sparsely pilose, with flat edges, the border of meatus plain in front. The term of the sub-genus is from the Greek—*pitus*, pine; hence, Pine-mouse.

PINE MOUSE (*A.* (*Pitymys*) *pinetorum, LeConte*).—This is a small Mouse, resembling a Mole, with close silky fur. The tail is shorter than the head. The hind-feet are small, with only five tubercles. The fore-feet are comparatively large. The ears are small, flat and round, with little hair, and nearly concealed in the fur. It inhabits the United States east of the Mississippi.

Arvicola (*Pitymys*) *quasiater, Coues*).—In general form and appearance this is like A. pinetorum. It is named as above from the *seemingly black* aspect of the fur, which, on closer inspection, however, is found to be of an auburn shade. This species is from Mexico.

SYNAPTOMYS.—*Baird.*

This is regarded as one of the most strongly marked genera of American *Maridæ*. "The most conspicuous and diagnostic character, if not really the most important, is the sulcation of the upper incisors. It is a unique feature among American *Arvicolinæ*, if not in the sub-family; and, in the American representative of the whole family *Muridæ*, only recurs in Ochetodon of North and Reithrodon of South America. The groove runs near the outer edge of the face of the tooth. In Ochetodon and Reithrodon it is median."

COOPER'S MOUSE (*Synaptomys cooperi, Baird.*)—This form is found in Indiana and Illinois, and west to Oregon and Alaska. Prof. Baird named this species from an imperfect specimen, the only one that could be obtained at the time. Dr. Coues has since received a number from Kansas, which fully answer to the characters recorded, Synaptomys being substituted for Myodes and Arvicola.

MYODES.—*Pallas.*

The skull in this genus is massive, low and broad; the width of the zygoma nearly two thirds its length. The molar series is long—more than one fourth the length of the skull—very convergent anteriorly; and the teeth are each very large. The details of the crowns of the teeth are like those of the preceding. The first upper and under molars are the longest. The Myodes are large, and have a long, thick pelage. The snout is blunt, covered with hair, excepting the nasal papillæ. The ears are small and concealed. The fore-feet are large; there is no thumb.

Myodes obensis, Brants.—This has a form closely like that of the Norway Lemming. It is found in Asia, as well as Western America.

CUNICULUS.—*Wagler.*

This genus is characterized by a skull lower and broader and more massive than in Arvicola, and somewhat less so than in Myodes. The zygoma is not two thirds the length. In general characters it resembles the preceding. Some dental peculiarities are recorded.

COLLARED LEMMING (*Cuniculus torquatus,* (*Pall.*) *Coues*).—This form is the only one of the genus in America, and it is indentical with that of Northern Asia. The Cree Indians call it "White Bear Mouse;" Pennant, the Hudson's Rat, and Hair-tailed Rat;

others call it Hudson's Bay Lemming. The specific name refers to certain Rabbit-like characters. The feet are densely clothed on the palms with fur, even in summer. In winter it is pure white.

FIBER.—*Cuvier.*

This genus was embraced in that of Castor, by Linnæus. It includes animals that are the largest of the family. The form is like that of the *Arvicolinæ*, but the tail is nearly as long as the body, without the head, and it has a flattened shape, with no hairy covering, but a recticulated surface. The toes are incompletely webbed. The ears are small, with prominent angular antitragus. The whiskers are short. The pelage is rather woolly in texture, with certain long, glossy hairs interspersed. There are six mammæ. The perennial glands are highly developed. The dentition is strictly arvicoline.

MUSKRAT (*Fiber zibethicus, (Lin.) Cuv.*)—This well-known animal is the only species of the genus. The peculiarities of tail and feet separate it from preceding forms. The great size, also, is a prominent character. It extends over the entire continent, being found from the Rio Grande to the Arctic regions.

FAMILY—ZAPODIDÆ.

JUMPING MICE.

This family is represented by only one species. It was assigned to the genus *Mus* by older writers, and has been regarded as belonging to the Jerboas (*Dipus*) on account of its resemblance to the latter in its exterior. This family is regarded, however, as fully distinct.

The dentition is as follows: Incisors, $\frac{1}{1}-\frac{1}{1}$; Canines, $\frac{0}{0}-\frac{0}{0}$; Premolars, $\frac{1}{0}-\frac{1}{0}$; Molars, $\frac{3}{3}-\frac{3}{3}$. The superior incisors are compressed and sulcate; the premolars small; the molars rooted. The cranial portion of the skull is shorter and broader than in *Muridæ*. The tail is much longer than the body, very slender, and nearly naked. The locomotion is by jumping.

ZAPUS—*Coues.*

The Zapus has well-developed cheek pouches internally. The hand has five digits, the first being rudimentary, with a flat, blunt nail. The palms are naked. The foot has five digits, with claws and webs at the base of each. The pelage is coarse and harsh.

JUMPING MOUSE; DEER MOUSE (*Zapus hudsonius, Coues*).—This odd little creature was first brought to notice by Pennant as the "Long-legged Mouse of Hudson's Bay," or a similar name. Under the head of Deer Mouse (*Meriones americanus*), DeKay describes this species. He says that it is common in all parts of New York State. The Indians called it *Wah-peh-sous*, or the animal that "jumps like a deer." It is said to leap ten or twelve feet at a bound.

FAMILY—SACCOMYIDÆ.

This family is recognized in the peculiar character of *external* cheek pouches, which are lined with a furry integument, and open outside of the mouth. A general murine aspect is also seen in the individuals. The only other Rodents that possess the external pouches are the *Geomyidæ*, which are entirely different in external aspect. The family name is derived from the Latin *saccus*, a bag. The skull is light, thin and papery. The mastoid processes are enormously enlarged, reaching to the top of the skull. The hind limbs are formed for jumping. The tail is as long as the body. The pelage is coarse and harsh, said to be mixed with flattened spines in some instances. There is no under fur. The species are very active, resembling Mice in their movements, occasionally leaping like the Jerboas.

SUB-FAMILY—PEROGNATHIDINÆ.—*Coues.*

This sub-family was instituted by Coues. It has, among other characters, rooted molars; compressed and sulcate upper incisors; an inflated temporal region (moderate as compared with others); and a comparatively hispid pelage.

PEROGNATHUS.—*Max.*

The upper incisors in this genus are small and compressed, inclining backwards. Their faces are deeply channeled with a longitudinal groove. The under incisors are small and simple.

BANDED PEROGNATHUS (*P. fasciatus, Max.*)—This is the largest of the genus. Its length is about four inches; the tail somewhat less. The ears are large. The soles are naked to the heels. The color above is reddish-yellow, closely lined with blackish. It inhabits the country between the Mississippi and the Rocky Mountains, and the northern portion of Mexico. The pelage of this species is harsh, and is likened to spun glass of a very delicate nature.

TUFT-TAILED POCKET MOUSE (*P. penicillatus, Woodh.*)—About the size of *Hesperomys leucopus*. It is a rare animal, found in the Basin of the Colorado River.

MOUNTAIN POCKET MOUSE (*P. monticola, Baird*).—About the size of *Mus musculus*. The tail of this species is quite a distinguishing feature, measuring, including the hairs, an inch longer than the head and body. The pelage is very soft and smooth for the genus. Color above, yellowish-cinnamon, lined with blackish; below, white. Its length is two and a half inches. It inhabits the western slope of Rocky Mountains, Utah and California.

HISPID POCKET MOUSE (*P. hispidus, Baird*).—This is about three inches long; the tail a little more. It is very rare. Coues speaks of only two species being known, these being from Mexico. "The fur is exceedingly stiff and coarse; the ear small, concealed in the fur. The soles are naked. The color above is yellowish-cinnamon, closely lined with blackish, the color not descending on the leg. The sides have a conspicuous fulvous stripe. The tail is bicolor. The under parts are white."

HONDURAS POCKET MOUSE (*P. bicolor, Gray*) is a species from the Isthmus. "It is dark brown above—not black—with harsh pelage."

CRICETODIPUS.—*Baird.*

This genus embraces quite diminutive animals, with hairy soles. The antitragus of the ear has no lobe.

YELLOW POCKET MOUSE (*C. flavus, Baird*).—This is much smaller than Mus musculus. The head and body measure two inches in length; tail the same. The ear is small, nearly concealed. The color above is a pale buff, blended intimately with blackish; below, including the whole of the fore-leg, pure white. The sides have a clear buff stripe. The tail is obscurely bicolor. About the ears are seen a few white spots. Habitat, the Rocky Mountain region, and south to Mexico. The pelage is very fine and glossy.

LEAST POCKET MOUSE (*C. parvus, Baird*) (*and Peale?*)—This is like the preceding, but has longer feet and tail. The habitat is the same.

SUB-FAMILY—DIPODOMYINÆ.

In this sub-family the molars are rootless; the anterior molar a simple prism. "The mastoids are extraordinarily developed, even for this family." The tympanic is completely bullous; soles of the feet densely hairy, like those of the Rabbit. The hind limbs are elongated, like those of the Jerboa, and formed for jumping. The pelage is comparatively soft for the family.

DIPODOMYS.—*Gray.*

The skull in this genus is light, papery, thin, depressed and tapering in front. The snout is pointed, projecting beyond the incisors. The lachrymals are greatly excavated; the mastoids extremely enlarged. The superior incisors are sulcate, and point strongly backwards; they are deeper than wide. Molars are simple and rootless. The general form is Jerboa-like, the hind-legs being very long. The tail is rather longer than the head and body. The eyes are large and full; the ears large and round. The whiskers are half as long as the whole body; the upper lip not cleft; ample cheek pouches; the pelage long and very soft. The size is that of a half-grown Rat. The dentition is simple. The incisors are small and delicate in both jaws, the upper being compressed; a deep groove runs down the centre of each.

KANGAROO RAT (*Dipodomys phillipsi, Gray*).—This delicate and graceful creature is found in the region of the Pacific slope. It is small, rather under four inches in length, slender, with large ears, long limbs, and especially long tail.

ORD'S POCKET RAT (*D. phillipsi ordi, Woodh.*)—This was described by Prof. Baird as D. montanus, and also as D. ordi. It is found in the Rocky Mountain region, and eastward, reaching into Mexico. It is larger than the preceding.

FAMILY—GEOMYIDÆ.

Animals embraced in this family are found in the cold-temperate and warmer regions of continental America.

GEOMYS.

This genus includes the forms having the superior incisors deeply channeled along the middle. The external ears are usually a mere vein of integument around the orifice. The fore-claws are enormously developed. The pouches are not pendulous, as was first supposed; they are wholly external, and lined with the fur of the integument.

COMMON POCKET GOPHER (*Geomys bursarius, (Shaw) Rich.*)—This novel creature abounds in the region about the Mississippi River, from Texas northward to Canada. Its length is seven to eight inches; the tail about two or three. The pelage is soft and Mole-like. Its specific name refers to the curious pocket or sack which is present in this group of animals on each side of the neck.

THE FLORIDA POCKET GOPHER (*Geomys tuza, (Ord) Coues*).—This was described by Bartram as the Ground-rat. It is known more generally as the SALAMANDER—an absurd name, as the latter is more properly a reptilian term. Mitchell called it Hamster, and Aud. and Bach. the Southern Pouched Rat. It is about the size and shape of the preceding, and is regarded as a "localized race" of the same.

THE PECOS, OR CHESTNUT POCKET GOPHER (*Geomys castanops, (Baird) LeConte*).—This is a rare form, found in Texas and New Mexico. Its color is a pale yellowish-brown above, inclining more or less to dull chestnut about the head; below, it is whitish. It is rather less in size than the preceding. The fore feet are shorter than the hind; the feet and tail nearly naked. "The superior incisors with a single median groove bisecting the face exactly." This feature of the front teeth gives an appearance of *four* incisors instead of two; the latter are orange colored.

THE TUCAN, OR MEXICAN GOPHER (*G. mexicanus, (Licht) Rich.*) is a Mexican species, with the coloration much like the bursarius, but is much larger than any of the United States species. Its pouches and hands are proportionally smaller. Its length is from ten to eleven inches; tail about three.

THE QUACHIL (*Geomys hispidus, LeConte*) is found in Mexico and Central America, where it is called CENTRAL AMERICAN POCKET GOPHER. Its most noticeable feature is seen in the nakedness of the tail and feet; the former being, in some cases, entirely bare. The hispid nature of the pelage is another prominent feature, being coarse, harsh and lustreless; it is long, and interspersed with stiff hairs The pouches are moderate in size. "The superior incisors with a single strong, deep furrow, lying wholly in the inner half of the tooth."

THOMOMYS.—*Max.*

This genus presents the following characters: "The superior incisors are without a median sulcus, but have a fine marginal groove (sometimes obsolete); the crowns of the intermediate molars acutely edged exteriorly. The roots of the inferior incisors cause a protuberance on the outside of the base of the condylar ramus, nearly as high as the condyle itself;

the end of the mandible thus singularly three-pronged. The external ears, though very small, are provided with a distinct auricle." The genus has a range from British America to Mexico, and from the valley of the Mississippi to the Pacific.

NORTHERN POCKET GOPHER (*Thomomys talpoides*, (*Rich.*) *Baird*).—This is very nearly the color of the House-rat. Its length is about six to eight inches. Its range is from Hudson's Bay to the Rocky Mountains, mostly on the west side of the Mississippi River.

PACIFIC POCKET GOPHER (*Th. talpoides bulbivorus*, (*Rich.*) *Coues*).—This is Geomys douglassi of DeKay, in *New York Report on Mam.*, and the same of Baird and Richardson. Its size is rather more than the last-mentioned species. The hand is somewhat shorter than the foot, owing to the claws being shorter. Habitat, Pacific Coast, from Washington Territory to California.

SOUTHERN POCKET GOPHER (*Th. talpoides umbrinus*, (*Rich.*) *Coues*).—T. fulvus of Baird, who also describes the present species. DeKay has it Geomys umbrinus. It averages smaller than either of the preceding. The length is about six inches. The fore-feet are decidedly less than the hind-feet. "The color varies from a uniform rich fawn to tawny-brown shades, with or without a blackish dorsal area. It is occasionally quite gray, sometimes a lustrous coal-black all over." Habitat, much as the preceding.

ROCKY MOUNTAIN POCKET GOPHER (*Th. clusius*, *Coues*).—This is the smallest known species. Its length is about five inches. The feet are remarkably small; the fore-claws weak, small and little curved. The muzzle is almost entirely hairy, with a very small, naked pad between the nostrils. The tail is very short. The ears are minute. Its color above is a pale yellowish-gray, with a slight light brown shade; below, it is nearly white. The feet and tail are white. End of snout blackish. The cutting-teeth are orange colored on the exterior. The mammæ are twelve in number. Like some other instances, this is so rare, or has so entirely escaped the attention of naturalists, that, at the time of publishing Dr. Coues' Memoir on these animals (who also described this species), there was but *one* specimen to examine; this was found by Dr. Wm. A. Hammond, then Asst. Surgeon U. S. A., at Bridger's Pass, Rocky Mountains, in 1857. It is now in the Museum of the Smithsonian Institute, Washington, and bears the number 3051.

SERIES III.—HYSTRICOMORPHA: HYSTRICINE RODENTS.

FAMILY—HYSTRICIDÆ.

The term *Hystrix* suggests the family designation, meaning simply, Porcupine. The Porcupines of the Old and New Worlds have been separated into two distinct families, although there is a marked resemblance. The latter differ from the former in having perfect clavicles; in the tail (with the exception of Erethizon) being prehensile, more or less; in the molar-teeth being fully rooted; in having less than five toes to all the feet; in having tuberculate soles; in the undivided upper lip; in a peculiar form of the lachrymal bone; and in some more or less important particulars of osteology. The skull differs in certain features from that of the Old World forms.

In South America certain forms are indigenous, which have been arranged under the sub-family title *Synetherinæ;* the genus Erethizon, which belongs to it, is the only one found north of Mexico.

ERETHIZON.—*F. Cuvier.*

NORTH AMERICAN PORCUPINES.

This genus is characterized by having four toes on the fore-feet, the hind being furnished with five. They are all armed with stout curved claws. The tail is short, thick and depressed; is not prehensile, and is beset on the top, at the base, with thick hairs and spines, and on other parts with rigid bristles. The limbs are short but strong. It embraces the largest of the American forms. Another character is seen in the close approximation of the nostrils. This, with the Porcupines of the Old World, formally comprised one genus, but the osteological features, particularly those of the cranium, are strikingly different. The present genus is represented by only one species, divisible, however, into two well-marked geographical varieties.

CANADA PORCUPINE (*Erethizon dorsatus*, (*Linn.*) *F. Cuv.*)—Plate II, fig. vi.—This creature, though indigenous to our land, is probably less known to most people than the African species, which, from time immemorial, has been *the* Porcupine to the readers of Natural History books. The *quills* of the "fretful Porcupine" are familiar objects, and the full-fledged "Corkintine" of "Patrick" is no less so to the visitors of menageries and zoölogical gardens. The American form has been kept alive in Central Park, New York, but its habits are such that few obtain a fair view of the creature. The notion, embraced almost universally, that these creatures "throw their quills" is wholly incorrect. The quills of the upper surface of the tail are loosely set in the epidermis, and their outer ends are barbed. The animal, when irritated, turns its tail towards the object, and, with rapid strokes, *drives* the quills into the flesh; the hold of their roots being so slight, and the barbs cling so closely, that the weapons are left in the wounds. We observed an Erethizon, which was confined in a small box with a half-grown Hare; both were evidently in fear, and clung closely to opposite corners. A momentary change of position caused the Hare to receive the full effects of the barbed battery of Erethizon. Myriads of the small missiles were seen thrust into the skin. The old keeper at Central Park affirmed stoutly that he "see 'em fly." Nevertheless, the truth remains—the quills must come in contact with some yielding object to sever their connection with the animal. The Erethizon is called CAWQUAW by the Indians of the North-west, and URSON in some regions. Emmons, in *Mass. Report on Mammals*,

1840, calls it simply Porcupine. DeKay describes it under the head of The North American Porcupine (*Hystrix hudsonius*). Richardson names it H. pilosus. DeKay says: "The Porcupine is an inoffensive animal, and very gentle in its manners. It feeds on the leaves and bark of the hemlock (*Pinus canadensis*), the bass-wood and ash. They move very sluggishly, and when irritated, make a faint whining noise. By a strong cuticular muscle they erect their spines when about to strike." Audubon records an instance of the terrible effects of the *stroke* upon a mastiff, whose face was so beset with the offensive weapons as to remain several weeks in a critical state of inflammation. Emmons, in *Report on Quad. Mass.*, 1840, says: "It dwells in dens, or under rocks, and in the hollows of trees. When assailed, it immediately throws its head between the fore-legs, and erects the spines on its back, and, at the same time, elevates its posterior parts and tail; if now touched, it gives a smart lateral blow with its tail." We have seen with what results. Emmons says that it is common in the vicinity of Williamstown, Mass., and that an albino is sometimes met with in Northern New York. This animal is too unique to be mistaken for another, although a variety exists, called the WESTERN PORCUPINE, variety epixanthus. This is similar to the other in external appearance, but the light tips of the long hairs are pale greenish-yellow, instead of white. The nasals are also broader and longer. The range of the Erethizon is throughout the United States, from Maine through the Middle States to Kentucky, but is not seen on the sea-board portions. It is not found in Virginia, according to Audubon. The western form reaches as far south as New Mexico and Arizona. Full-grown specimens average about thirty-five to forty inches in length.

Two extinct forms are recorded in the chapter on Extinct *Rodentia;* these are interesting, as being related to the Old World forms more closely than with our present.

SUB-ORDER—DUPLICIDENTATI: LEPORINE RODENTS.

FAMILY—LEPORIDÆ. HARES.

This family is the subject of a Memoir by Mr. J. A. Allen, in the work on *Rodentia*, published in connection with *Hayden's Reports on Geology* (1877). As with the other Memoirs, we acknowledge their extremely valuable aid in the presentation of our work, as it becomes absolutely necessary to make extensive abstracts therefrom. The author remarks: "The present revision of the American *Leporidæ* is based upon the material contained in the National Museum at Washington, supplemented by that of the Museum of Comp. Anatomy at Cambridge. The specimens in the Museum of the Boston Society of Natural History have also been examined. The author has thus had access not only to the types of the species described by Prof. S. F. Baird, in his great work on *The Mammals of North America*, published in 1857, but also to nearly all the material used by him in his excellent elaboration of this family in the above-named work, together with the vast amount of material that has since accumulated at the Smithsonian Institute. * * * As an indication of the amount of material used in the preparation of the present Memoir, it may be stated that of Lepus americanus, and its varieties, the series of skulls alone numbers about one hundred and fifteen, which is supplemented by about the same number of skins; of Lepus sylvaticus, the skulls number seventy, and the skins about one hundred and fifty."

The family *Leporidæ* is represented in both American continents, but by far more numbers in the temperate parts of North America. One species only reaches the Arctic (Lepus timidus), which also ranges around the globe in the same latitudes. Lepus braziliensis is the only form of *Leporidæ* yet found in any part of South America, its range extending from Patagonia northward to Central America. It is not anywhere abundant. The great interior arid plains furnish the greater number of species, four being found there. The Hares are regarded as forming one of the most "natural and best-defined groups among mammals." The genus Lagomys is excluded from the present exhibit of *Leporidæ*, but is considered their nearest ally, there being evidently only a generic difference. The lengthened limbs furnish the principal features in the characterization of the Hares, with the long ears, short and erect tail. The skull also presents some distinguishing features. The dental formula is as follows: Incisors, $\frac{2}{1}-\frac{2}{1}$; Canines, $\frac{0}{0}-\frac{0}{0}$; Premolars, $\frac{3}{2}-\frac{3}{2}$; Molars, $\frac{3}{3}-\frac{3}{3}$; $=\frac{16}{12}$; $=28$. The molars have no roots.

LEPUS.—*Linn.*

The characters of the genus are well presented in the description of the family. Mr. Allen presents in his Memoir a very careful "analysis of the species and varieties."

POLAR HARE (*Lepus timidus, Linn.*)—This is the only species found in the Arctic regions, being an inhabitant of the whole Arctic circle. It is pure white in winter, with the exception of the tips of the ears, which are black. Its summer pelage is a "light yellow-brownish-gray, varied with black; ears black; rump and upper surface of tail, sooty-plumbeous. Ears rather shorter than the head; the hind-feet much longer than the head; length twenty-two to twenty-six inches; weight seven to eleven pounds." The L. variabilis of Pallas, a European form, L. hibernicus, and several others of the Old World, are regarded as the same species as the present, the variations being very slight. It is found as far south as Labrador and the northern shore of Great Slave Lake.

PRAIRIE HARE (*Lepus campestris, Bach.*)—This has been described as L. variabilis by Lewis; L. virginianus by Harlan and Richardson; and L. townsendi by Aud. and Bach. In winter it is white, more or less tinged with yellowish-brown on the middle of the back. In summer it is a yellowish-gray in its

upper parts; the under, white. The tail is very long, equal to the head. The ears are long, about one fourth longer than the head. The hind-feet are rather longer than the ears. Length of body, nineteen to twenty-three inches. This was first described by Lewis and Clark, in 1814. Its easternmost locality, as far as known, is Fort Riley, Kansas. Further north, it extends to the Missouri and to the Pacific. It is abundant in the Salt Lake Valley.

NORTHERN VARYING HARE (*Lepus americanus, Allen*).—This is the Northern Hare of DeKay; L. virginianus of Harlan; L. variabilis of Godman; Prairie Hare of Emmons, in *Mass. Reports*. Four varieties are described; the present is white in winter, with the tips of the ears narrowly bordered with black; in summer, above and outer surface of limbs, pale yellowish-brown, varied with black; beneath, white. Length of body fifteen to twenty inches.

The Southern variety, L. virginianus, is similar in size and proportions to the preceding. The winter pelage has more or less brown mixed with the white of the upper parts. In summer the pelage is more rufous, the color being a rich reddish-brown.

The Western Varying Hare, variety washingtoni, is "rather smaller than the first, with the summer pelage of a somewhat stronger reddish tint, probably white in winter, except in the vicinity of Puget's Sound, where they have been observed to retain their summer pelage the whole year."

The Rocky Mountain variety, bairdi, is about the same in size as the first-named. "The most prominent distinctive feature in Baird's variety is in the summer pelage having pure white under fur, long black tips to the hairs, and white feet, and, in winter, the tendency of the pelage to become pure white to the base. The ears appear to be relatively longer than in any other form." It is a strictly alpine animal, inhabiting the snowy summits of the higher peeks of the Rocky Mountains.

The species in some form is found in all parts of the wooded portion of the northern half of the continent, extending to New Mexico. DeKay says: "It occurs in most parts of the State of New York. In the winter the markets are stocked with them from the Kaäterskill and Shongo Mountains. It produces four to six young to a litter. It makes more resistance when seized than any other species." Emmons, in *Mass. Report on Quadrupeds*, says: "It exhibits more of the habits of the English animal of this name than either of the other species peculiar to this country. Its color scarcely changes in this climate."

WOOD HARE (*Lepus sylvaticus, Bach.*)—This is represented by three varieties. The term GRAY RABBIT is very commonly used to designate the three. The present variety, called L. nanus by DeKay, is not so large as the preceding, being from thirteen to seventeen inches in length. It is found from Hudson's Bay to Florida. It is timid and inoffensive. It does not burrow, but makes a *form*, a slight depression in the ground sheltered by some shrub. Sometimes it resorts to the root of a tree, or stone wall, where it may find sufficient shelter to rear its young. It breeds, in Massachusetts, three times in a season, producing four to six at a birth. Its general form and habits are so much like those of the English Rabbit that the term has been applied to it in the Northern States.

A variety, nuttali, called the SAGE HARE, differs only in its paler tints and rather smaller size.

The variety arizonæ—the DESERT HARE—is rather smaller yet, and paler. This, as well as the preceding, is called "Cotton-tail" on the Western plains. The ears are much larger than those of the preceding varieties. Its habitat is in the deserts of Arizona.

Variety audubonii is about the size, or a trifle less, of the first-named.

This species, in its several varieties, occupies a large portion of the southern half of the continent. It extends from Southern Maine to Florida.

TROWBRIDGE'S HARE (*Lepus trowbridgei, Baird*).—This is the smallest of the family. The tail is very short, almost rudimentary. The ears, head and hind-feet are about equal in length. Its color above is yellowish-brown, varied with dark brown; beneath, it is dusky gray, varying to whitish; the back of the neck is rufous. Its habitat is east of the Cascade Range, and along the coast to Cape St. Lucas, from Fort Crook on the north. It was first described by Prof. Baird, in 1855.

GRAYSON'S HARE (*Lepus graysoni, Allen.*)—This is a new species, described by Mr. Allen from a specimen procured at Tres Marias Islands by the late Col. A. J. Grayson. It is about the size of L. sylvaticus, but differs considerably in certain features. "The general color is above, pale rufous or dull cinnamon-brown, varied with blackish-brown; below, whitish; upper surface of the head, ferruginous, finely mixed with black, fading anteriorly to paler rufous; sides of the muzzle, yellowish-brown; sides of the head, pale fulvous brown; below and behind the eye, sparsely varied with black; a narrow, pale ring around the eye, not more conspicuous than in L. sylvaticus; nape rufous; * * * tail above, blackish-brown, shading into the color of the rump; *white below.* * * The feet are small; nails naked." One other specimen has been added to this (number 8318 Smithsonian Institution), and is numbered 11,409. It is from Talmanca, Costa Rica.

BRAZILIAN HARE (*Lepus braziliensis, Linn.*)—This is called, also, TAPETI. It is about the size of L. sylvaticus, or a trifle smaller. The ears are rather longer, and the tail shorter. Its fur is short and harsh. Habitat, Paraguay, northward to Central America.

CENTRAL AMERICAN HARE (*Lepus braziliensis, var. gabbi*).—This is the size of L. trowbridgei. Its ears are very short; tail is rudimentary. Its color above is pale cinnamon-brown, strongly varied with blackish. The whole upper surface of the head is a "bright yellowish ferruginous, mixed with black; a conspicuous large whitish spot, below and behind the nostril, bordered by a yellowish-brown, which latter color extends over the sides of the head, where it is varied with black. The most striking peculiarity in this species is the shortness of the ears, which are much more so than in any other."

MEXICAN HARE (*Lepus callotis, Wagler*).—This is seen in two varieties—the NORTHERN JACKASS HARE and L. texianus of Aud. and Bach. In color, is a pale ashy-gray above, tinged or mixed with brownish or black. The ears are more or less tipped with black. The tail is black above.

The Southern variety, callotis, is a trifle smaller; the black of the ear-tips nearly obsolete, being replaced by a yellowish or pale white. The species is nearer L. californicus than others. Habitat, from Oregon to Mexico.

THE CALIFORNIAN HARE (*Lepus californicus, Gray*) is about the size, or a little smaller, than the preceding. The ears are about the same as in that species; the hind-feet shorter. Its color is the same, but stronger in tints. It ranges from the northern part of California southward to Cape St. Lucas; its range east is limited by the Sierra Nevada Mountains. Dr. Gray first described it, in 1837, under the present name.

MARSH HARE (*Lepus palustris, Bachman*).—About as large as L. sylvaticus, and generally resembles it; but has a much shorter tail, and incisors broader and heavier. The ears are broader and more rounded. Its color above is a yellowish-brown, inclining to rufous, strongly shaded with black. It was first described by Bachman, in 1837. Its habitat is the low-lands of the South Atlantic States; its most northern locality yet known is about Fort Macon, North Carolina. It is found in Florida and in Mexico. Specimens were found by Mr. Ridgway, in Mt. Carmel, Illinois. He says: "It is very common in bottom-lands, where it frequents bushy swamps and the borders of creeks."

WATER HARE (*Lepus aquaticus, Bach.*)—This Hare is as large as L. americanus. In color, it is like L. sylvaticus. Its length is nineteen to twenty inches. Its pelage is rather harsh. The feet are sparsely furred. It abounds in the cane-breaks of the Gulf States, and reaches as far north as Missouri.

THE EUROPEAN RABBIT (*Lepus cuniculus, Linn.*) is extensively acclimated in this country. On Sable Island, off Nova Scotia, it exists in a wild state, where, it is said, it has in fifty years assumed "one common silvery-gray tint, with white collars." "Rabbit Key," near Key West, is quite overrun with the Rabbits which live in burrows. In 1861, the writer procured a male Lop-eared Rabbit and a common gray female, and kept them in Fort Jefferson, Dry Tortugas, Florida. They increased to a great extent, and several pairs were placed on Loggerhead Key, in the neighborhood; here there was no population, save the light-keeper and family, the island being about ten acres in extent, and covered by cactus and "bay cedar." The Rabbits increased very rapidly, and have since been a source of comfort to the few individuals there resident. The meat of the creatures is not so palatable as when reared in the north, yet is a God-send to those who find other meat difficult to procure. This experiment was instituted after being told that the Governor-General of Jamaica maintained a warren, and used the Rabbits for food. We did not find them the luxury that they prove to be in more temperate climes. The breed presented a great variety of aspect. The ears of some were exceedingly long and erect; others were full "lop-eared." These Rabbits burrowed, and they subsisted upon the succulent plants of the sandy cay; the wild portulacca being the most common. The term Rabbit is distinctively a specific name, and is applicable to the English L. cuniculus only. The word Hare is applied to our American forms, and means more than one kind. The short legs of the former, and its habit of burrowing, distinguish it especially from any other.

FAMILY—LAGOMYIDÆ.

In this group the dentition is much like that of the Hares. For a long time the two were embraced under one head. The Pikas, as they are termed, "have the dorsal outline of the skull gently arched, the occipital portion being but slightly below the plane of the inter-orbital region, instead of being greatly depressed, as in the Hares. The orbits are much smaller, and open more upwardly, and the zygomatic processes arise at a much higher level. * * * In general form, the skull is depressed or flattened, greatly expanded posteriorly, and narrowed anteriorly. The cutting edge of the front upper incisor is gouge-shaped, instead of chisel-shaped." The Pikas are nearly tailless. The general form is like that of the *Arvicolæ*. There is a well-developed clavicle; the toes number five in front and four behind; at the base of each toe is a prominent naked pad. These creatures are delicate and tender, inhabiting the loose rocks about the high mountainous cliffs. They are social, living in communities, and store up food for the colder season. They sit up on their haunches, like the Marmot, and "utter a sharp, shrill, barking cry." One species only is known in North America, which is confined to the mountainous range of the West. Western Asia is the home of the remaining species.

NORTH AMERICAN PIKA (*Lagomys princeps. Rich.*)—This creature, known also as the LITTLE CHIEF HARE, is about seven inches in length. Its ears are broad, large and rounded. "The color above is grayish-brown, varied with black and yellowish-brown; the sides, yellowish-brown; below, grayish, more or less strongly tinged with pale yellowish-brown. Whiskers are numerous, one to two and a half inches long; in some nearly black. The texture of the pelage is much as in *Arvicolæ*, especially in A. xantho, being much firmer than in the Hares, with a much smaller amount of soft under fur." Habitat as above, ranging along the summits of the Rocky Mountains to British America. Mr. Allen found it "very abundant near the limits of trees, in the vicinity of Montgomery, Colorado. They appear to rarely wander from their home; are timid, yet easily become familiar. Though retreating when first alarmed, they soon come cautiously out of their holes, till one may hear their sharp little cries in every direction. Their color so nearly resembles the rocks they live among that they are not easily seen,

and their cry is such as to easily deceive one in respect to the point from which it proceeds. They sit erect, like the Marmots, and in no way resemble Hares in habits."

SOUTH AMERICAN RODENTIA.

Waterhouse, in his work *On the Arrangement of the Rodentia*, divides the order *Rodentia* into three great families—the Mice, the Porcupines and the Hares. Subsequently he added the Squirrels. Murray has added two families, which include Hyrax and Toxodon. In considering the South American forms, we will follow the arrangement exhibited by Andrew Murray (*Distribution of Mammals*, 1866).

FAMILY—HISTRICIDÆ.

This family embraces, besides the Porcupines, the Cavies, or Guinea Pigs, the Chinchillas, the Chilian Squirrels, or Octodons, the Spiny Rats, and the Pacas and Agoutas.

THE CAPYBARA (*Hydrochœrus capybara, Erxl.*)—Plate II, fig. v.—This bears a local name of WATER HOG, its generic title meaning the same, and its habits and aspect suggest a relationship to the pachydermatous animals. It is well known as the largest living Rodent, its size being about that of a half-grown Hog. This creature is not familiar, though of late it is occasionally seen alive in the Zoölogical Collections. It is fond of the water, and dives with great facility, remaining under the surface, it is said, eight or ten minutes. Its food is entirely vegetable. It is gregarious in habit, herding upon the banks of streams, where it finds ready means of seclusion by diving—its sluggish habit and bulky form rendering it an easy prey to the Jaguar or other large Cats. It ranges over the whole of South America, east of the Andes.

THE PATAGONIAN CAVY (*Dolichotis patagonica*) is like a long-legged Hare. It differs from the Cavies generally in having quite conspicuous ears; and its tail is more developed. Mr. Darwin, who visited the region, says: "This animal is found where the country is a desert. It is a common feature in the landscape of Patagonia to see two or three Cavies hopping about, one after another, in a straight line, over the gravelly plains which are thinly clothed with a few thorny bushes and a withered herbage." This creature is also called MARA. It does not burrow, but nests in a form.

GUINEA PIG (*Cavia cobaya*).—This is a well-known animal, but most absurdly named, as it is neither a Pig nor a Guinea animal. Possibly it may have been called *Guiana* Pig originally, as it is said to have descended from the wild species that is indigenous to Brazil and Guiana. It is too familiar to require more notice.

SUB-FAMILY—CHINCHILLINÆ.

The Chinchillas are especially circumscribed, being found only in South America. They have four molars, rootless, in each side of the jaws, and smooth and simple incisors. The true Chinchillas have four toes, with a rudimentary fifth on the fore-feet, and four on the hind-feet. They are gregarious, feeding on roots, and live in burrows or in rocky hillsides. The species C. lanigera is prized for its fur; and the demand is said to sensibly encroach upon their numbers. The ancient Peruvians are said to have used this fur in the manufacture of their fine fabrics. The hinder limbs of these creatures are elongated, being nearly twice the length of the fore limbs. The ears are notably large; the clavicles are well formed; and the tail is developed to a tufted and quite ornamental feature.

THE CHINCHILLA (*Chinchilla lanigera*)—Fig. 48, vol. i, p. 141—is about the size of a full-grown Rat; the tail being five or six inches in length, and so clothed with hairs as to give an aspect of greater size to the creature. The fur is an ashy-gray; the inferior parts whitish. A peculiar aspect is given them by the great size of the eyes and globular shape of the large ears. There are also abundant whiskers. In habit, this little animal is exceedingly docile, and is much prized in its native regions as a house pet. Like some other Rodents, they are extremely prolific, otherwise they would long since have been extinct.

THE CHINCHA (*Lagotis cuvieri*) is much like the ordinary English Rabbit in size and general appearance; particularly, it has Rabbit ears; hence the generic name. It lives on the western slope of the Andes, where it is gregarious, occupying the burrows of other animals, or the loose stony localities of the mountain sides.

Another species, L. pallipes of Bennet, is much like the present. It is a singular fact that the fur of these animals comes off the skin immediately after death, at the least touch.

THE VISCACHA (*Lagostomys trichodactylus*) is not to be confounded with the preceding, which sometimes bears the same name. This species is also called BISCACHO and MARMOT DIANA. It occupies the eastern slope of the Andes, where it was seen in companies by Mr. Darwin and others, living in holes. A singular habit is related by the former: "The Viscachas drag every hard object to the mouths of their burrows. Around each group of holes many bones of cattle, stones, thistle stalks, hard clumps of earth, etc., are collected into a heap, which frequently amounts to as much as a wheelbarrow would contain." No explanation has yet been given of this singular habit.

An extinct genus, Archæomys, with two species, is found in Europe.

SUB-FAMILY—OCTODONTINA.

These animals are related to the preceding, and their habits are much the same; their range being chiefly along the Andes and their base. Many of them inhabit the west side of the mountains. The molars have no true roots. The members of the family are mostly small, with strong fore-feet, armed with powerful claws. The hind-feet in most are

pentadactylous, while some are tetradactylous. Several fossil extinct forms have been found in South America.

BENNET'S HABROCOME (*Habrocoma bennetii*).—This form exhibits, in common with others of the family, remarkably large auditory bullæ; and there is the unusual number of seventeen ribs. The incisors are narrow; and the crowns of the superior molars have a single fold internally; those of the inferior are angular, and directed forward. The ears are large and nearly naked; the whiskers long. The feet are four-toed; and the tail is of medium size. The pelage is soft and close. Another species, H. cuvieri, is much the same.

CUMMINGS' OCTODON (*Octodon degus*).—This is a Chilian species; called, also, the CHILIAN SQUIRREL, from its habits of climbing. The aspect is much as with the Chinchillas, with large, round and naked ears. It burrows and lives in communities, and has some of the habits of the Rabbit. Two other species are known, as follows: O. bridgesii and O. peruana.

THE SCHIZODON (*Schizodon fuscus*).—This is an inhabitant of the eastern slope of the Andes. Its habits are nocturnal. One species only is known.

THE SPALACOPUS (*Spalacopus pœppigii, Wagler*).—This is found in Chili, with habits similar to the preceding. One other species is known only—S. noctivagus. The generic name is probably from a resemblance of the ears to those of the Spalax. This latter species has a glossy and rich purple-brown fur. The incisors are of a pale yellow in front. The molars are indented on either side, so that the figure eight is clearly represented; hence the family name, from *Octo-don*. The ears, unlike the preceding forms, are very small; and the tail is very short.

BRAZILIAN CTENOMYS (*Ctenomys braziliensis, Waterh.*)—This is peculiar to Brazil and neighboring countries. The molar-teeth are simple, decreasing in size from before backwards, the last one with a semi-cylindrical form, the upper series being obliquely lunated, with the concavity directed outwards; the form of the lower group is oval. The eyes and ears are small; the tail is short; the fore-feet furnished with powerful claws, at the base having certain stiff hairs, directed inwards; these probably give the name—*Ctenos*, the Greek for comb, referring to these comb-like hairs. Habits are like those of the family. Other species are C. boliviensis, C. leucodon and C. magellanicus.

SUB-FAMILY—ECHIMYINÆ.

SPINY RATS are the animals embraced in this group. They are not attractive, and appear to be less known than most others. One genus, Pteromys, is found at the Cape of Good Hope, and another, Aulacodus, in West Africa.

An extinct genus, Carterodon, is found in the bone caves of Brazil. Genus Capromys, with two species, is found in Cuba. Seven other genera are found in South America, represented by twenty-one species. The Capromys is represented by C. prehensilis, and C. pilorides. They are confined to the West Indies. In habit they are slow and somewhat Bear-like. Obiedo described one as being named locally CHEMIS. Another form in this group is Plagiodonta ædium, found in St. Domingo.

THE COYPU (*Myopotamus coypus, Molina*)—Plate 16, fig. 51.—This is a notable form. A specimen of the adult Coypu is in the American Museum, in Central Park, N.Y., and, as there represented, it is a mammoth Rat. Its length is about two feet six inches, having all the aspects of the common Norway Rat. It is a native of the streams in the region of the Amazon. It is a lively animal, having some of the habits of the Beaver. Its tail is round, and like that of the Rat. The fur is used largely in the hat manufacture. It is said that 800,000 skins have been imported into Great Britain, under the name of *Neutria* skin.

Cercomys is represented by one species. Pteromys has one species in Africa. Dactylomys has three species; Loncheres, nine; Mesomys, two; and Echimys, five.

SUB-FAMILY—DASYPROCTINÆ.

The genus Cœlogenys has two extinct species in the caves of Brazil.

PACA (*Cœlogenys paca, Linn.*)—This is also called the SOOTY PACA. On account of two cheek pouches seen in this genus, the name Cœlogenys—meaning hollow-cheeked—is applied. The exterior of the cheek bone is singularly rough, and the bone remarkably developed. This is a very pleasing-looking species; prettily spotted. Its length is about two feet. It is quite stout and heavy. Its propensity to eat the sugar-cane renders it a troublesome creature to the planters of the West Indian Islands. It burrows like the Rabbit. Its flesh is esteemed a luxury; but the fur is of no value, being harsh and wiry.

AGOUTI (*Dasyprocta agouchy, Erxl.*)—This is a comparatively familiar animal, being often seen in Zoölogical Collections, alive. It is nocturnal in habit, and is said to eat meat at times, as is the case with some other Rodents. The name Dasyprocta refers to the curious mat of hair which hangs over its hind-quarters. It is a native of Central South America. Seven species are enumerated; and one fossil and extinct from the bone caves of Brazil.

SUB-FAMILY—HYSTRICINÆ.

Among the Porcupines of South America is the genus Chætomys, with one species. Cercolabes is represented by six species and three fossil ones.

CŒNDOO, OR BRAZILIAN PORCUPINE (*Cercolabes prehensilis*).—This is a remarkable creature in its armor of spines and its prehensile tail, as well as peculiarly-armed claws. Its habits are arboreal, finding its food among the lofty branches of the forest, in which it continually dwells. Including the tail, it is about three feet in length. It is nocturnal, sleeping most of the day. One species of this genus, the palidus, is a native of the West Indies. An extinct genus is found in two fossil species in Europe. One species is found in Eastern Mexico. Three extinct fossil species are known from the bone caves of Brazil.

FAMILY—LEPORIDÆ.

One species only of this family is known to South America, viz.: the Lepus braziliensis. The sub-family *Myoxini* is wholly of the Old World.

FAMILY—SCIURIDÆ.

Murray enumerates eleven species of this family in the genus Sciurus. None of Pteromys is known in South America—nor are the genera Tamias, Spermophilus, Cynomys and Arctomys.

FAMILY—MURIDÆ.

Of this family, *Castorinæ* is absent in this continent, the Beavers being confined to the northern half of the hemisphere. The *Arvicolinæ* are also missing here. The genus Reithrodon is represented in this region by three species, all being found on the southern coast, near Straits of Magellan; later writers place them in the genus Ochetodon. Of the *Murinæ* (or Mouse proper), only two species are known in South America. The sub-family *Hesperomyinæ* is represented pretty fully in South America. Calomys has thirteen species, ranging from the extreme north to Patagonia. Habrothrix has nine species and one extinct fossil. Oxymycterus has six species, in Peru, Brazil and Chili. Holochilus has five species, ranging over the entire continent. Alzodon and Drymomys have each one species, the former at an elevation of 14,000 feet.

GEOGRAPHICAL DISTRIBUTION OF RODENTS.

THE SCIURIDÆ, according to Wallace, as we have previously recorded, present in eight genera from one hundred and eighty to two hundred species, none being indigenous to the West Indies, Australia and Madagascar. The southernmost limit in South America is Paraguay.

Of the genus *Sciurus*, one hundred and twenty species are recognized. Sciuropterus has sixteen to nineteen; Tamias, five; Spermophilus, twenty-six; Arctomys, eight.

Andrew Murray remarks, in his *Geographical Distribution of Mammals:* "Anatomically and physiologically considered, the best classification of the Squirrels is into true Squirrels and Marmots—a division which, with the exception of a single genus, (Tamias), corresponds very nearly to the terrestrial and arboreal Squirrels. The terrestrial Squirrels consist of the Marmots (Arctomys), the Prairie Dog (Cynomys), and the Spermophiles. The genus Tamias is also terrestrial, but in structure and affinity belongs to the arboreal section, which, besides it, contains the true Squirrels (Sciurus), the Spiny Squirrels (Xerus), and the Flying Squirrels (Pteromys). Like the Hamsters and some other Rodents, a considerable proportion of the Squirrels possess cheek pouches. All the Spermophiles and Tamias have largely developed internal cheek pouches; and Arctomys has traces of them. In a family containing such an army of species as the Squirrels, one is glad to be able to break it up into brigades. After separating them from the Marmots, Ground Squirrels and Flying Squirrels, we have a very homogeneous section—the Squirrels proper—which peculiarly require farther subdivision, but for which it is scarcely possible to find good sectional characters. One small section may be, without inconvenience, taken from it, viz., the Bristly Squirrels (Xeri). These are Squirrels with bristles or spines in their fur, and are confined to Africa, south of Sahara. The remaining are still numerous—about one hundred and eighty species—of which the one half are synonyms; and I have little doubt that, if the remainder were subjected to the same stringent scrutiny that Audubon and Bachman's North American species have undergone at the hands of Dr. Baird, they would be correspondingly reduced."

The genus *Sciuropterus* is most largely represented in the Indian Archipelago—about a third of the whole are North American—and a single species (Sc. volans) is found in North-eastern Europe and North-western Siberia. There are fifteen species in all (a less number than given by Wallace); though the latter author probably includes the six or seven species of Pteromys in the genus Sciuropterus.

The six or seven forms embraced by *Pteromys*, according to Murray, are peculiar to East India and the Archipelago. He also places two species of Tamias in Europe and Asia, and the remaining "four or five" species in America.

Of the *Spermophiles*, Murray enumerates "twenty-five species, of which one is extinct, and has left traces in the bone breccias of France and Germany." Of the others, "nine are Old World and fifteen North American species." None are found south of the temperate latitudes of the northern hemisphere. "Only two occur in Europe." No Spermophiles are seen on the eastern border of the American continent.

Cynomys, the genus which includes the Prairie Dogs, is entirely North American.

Arctomys, the Marmots, according to Murray, are represented by seven species, three of which inhabit the Old World, the remaining species being peculiar to the New.

THE MURIDÆ, according to Andrew Murray, are represented by twenty-seven species of Arvicola, not found on the American continent; these are mostly indigenous to Europe and Asia, one being African. The latter determination he doubts, however. None are found in South America.

Of the SPALACINÆ, as recorded by Murray, eighteen species are of the Old World, mostly in the northern parts of Europe and Asia. The curious forms of Blind Mole-rats are from South Africa. None of this group are American. Wallace makes seven genera and seventeen species, grouped under the family term *Spalacidæ*.

THE SACCOMYINÆ, in Murray's arrangement, are all American, and confined to the northern hemisphere. Wallace gives six genera and thirty-three species, embraced in the family *Saccomyidæ*.

THE CRICETINÆ are all Old World forms. The true Hamster (Cricetus) is the most familiar species common in Middle Europe.

SIGMODONTES are represented nearly exclusively in North America. Ochetodon is now regarded as embracing both forms, which were formerly placed in the genus Reithrodon. These species are given, with more particulars, in connection with the genus Ochetodon, previously mentioned.

Of the HESPEROMYINÆ, which are so largely North American, Murray presents thirteen species of Calomys as exclusively South American. Habrothrix has nine species, confined to South America. Oxymycterus has six species, with the same circumscribed range. The genera Holochilus, Akodon and Drymomys have respectively four, one, and one species, equally confined to the same limits.

Murray enumerates ninety-eight species of the genus Mus—all Old World—forty-five being Asiatic, twenty-six African, five European, and the remainder in the Pacific Islands. None are American; the Common Rat and Mouse being the same as the European forms, which have been introduced.

Of the MURINÆ there remain three genera and five species, indigenous to South Africa and New South Wales. These are the genera Steatomys, Pseudomys and Dendromys.

The SMINTHINÆ have four genera and sixteen species, many of them in Africa and Asia; two are in the South Sea Islands. Hydromys is one of the latter, in the marl of Issoire. Hyrax is placed in the list of Rodents by Murray, and six species are enumerated, all from Africa, excepting one from Syria.

DASYPROCTINÆ.—The genus Cœlogenys has one species—the Caca, in South America. Two fossil and extinct species are known in the bone caves of Brazil, viz.: C. laticeps and C. major. Dasyprocta agouchy, and six others, are South American.

ECHIMYINÆ.—This is represented by Capromys and two species, habitat Cuba; Plagiodonta, one species, St. Domingo; Myopotamus coypus, the notable "big Rat," or "Coypu," of Brazil; Cercomys, one species; Pteromys, one species; Dactylomys, three species; Loncheres, nine species; Mesomys, two species; Echimys, five species; and a fossil extinct genus, Carterodon—all South American. Aulacodus, with one species, is an African genus.

OCTODONTINÆ.—Habrocoma has two species; Octodon, one; Schizodon, one; Spalacopus, two; Ctenomys, four—all South American. Wallace places in the family OCTODONTIDÆ, eight genera and nineteen species.

CHINCHILLINÆ.—Lagostomys has one species; Lagidium, two; Chinchilla, two—all South American. Wallace places three genera and six species in the family.

CAVIINÆ.—The great Hydrochœrus belongs to this group. One species is known only. An extinct one, Sulcidens, has been found in the Brazilian caves. Dolichotis has one species, Anœma has one, and Cavia has ten species, besides three fossil extinct forms from the caves of Brazil.

TOXODONTIDÆ.—This represents an extinct family, established to admit a gigantic form of water Rodent, larger than the present Capybara. It is closely allied to the latter. Andrew Murray regards the Hyrax as "connected with the Capybaras, and, on the other hand, with the Pikas and Hares." Certain bones were found by Mr. Darwin, near Bahia Blanca, in South America. The name Toxodon platensis has since been applied to the species recognized from them. The skull represents a large animal for a Rodent, being two feet four inches in length, and one foot four inches in breadth. This skull has incisors like those of the Hare; the principal ones being supplemented by an additional small one directly behind, as in the Hares. The molars were seven in number on each side. "The dentition," says Prof. Owen, "closely approached the Rodent type, and tended to complete the chain of affinities which link the Pachydermatous with the Rodent and Cetaceous orders." The Toxodon is supposed to have been twelve or sixteen feet in length.

A form has lately been described by Prof. Marsh, from the Upper Miocene of Oregon, which is regarded as different from any now in existence, called Allomys, and thought to be allied to the Flying Squirrels, but having molars somewhat resembling those of the Ungulates. The Pliocene of South America furnishes a new genus—Cardiodus. In the Post Tertiary the Rodents were very abundant, but the species were, in most cases, different from those now living.

PECTINATORIDÆ is represented only in Africa, by a few species of two genera.

MYOXINI has six genera and thirteen species, distributed throughout Europe, Asia and Africa. The little Dormouse of England is an example of the group.

LEPORIDÆ is represented by thirteen species of Rabbits and Hares in Asia, by seven in Europe, by five in Africa, and the remainder are found in North America, excepting one species, which is indigenous to South America. About forty species are known, included in one genus.

HISTRICINÆ.—In this sub-family are embraced four genera. Wallace makes three in the family. Chætomys, with one species, is South American; Cercolabes, with six species, is from the same region; and also three fossil extinct species. Erethizon has two species or varieties in North America; Hystrix, the typical genus, has seven species, all African. An extinct genus—Theridomys—has three species in Europe; Meriones is represented in Africa by twenty species, and in Europe and Asia by seven species; Mystromys and Otomys, with three and four species respectively, are found in South Africa. In New South Wales and Australia the genus Hapalotis is represented by eleven species.

DIPODINÆ.—Of this group the genus Dipus, including the Jerboas, has seven species; two are exclusively European, and the remainder African. Alactaga, of the same group, has eight species. Asiatic and African. Jaculus is American. Wallace's family, *Dipodidæ*, includes three genera and twenty-two species.

ORDER VIII.—EDENTATA.

TOOTHLESS animals are indicated by the term of this order, though all of the animals embraced herein are not without teeth. A few have none; some have a full complement of molars, and no others; and one form exhibits a set of incisor-like teeth, as well as the usual molars. Most of them, however, agree in the absence of incisors and canines. Though this order includes many quite dissimilar forms, and those of widely different habits, yet, in certain points of structure, there is a manifest affinity. The strong feet and claws of most species, and their general sluggishness, clumsy forms, and want of intelligence, are quite characteristic of the group. They are nearly peculiar to South America, although feebly represented in Africa and India. The teeth are very simple; there are no roots and no enameled cappings to the crowns. It is a notable circumstance, that though the present living forms of this order are comparatively small and insignificant, the extinct species are remarkable for the gigantic dimensions many or most of them exhibit, as we may judge from the very perfect remains that are found in the caves and various deposits.

Dr. J. E. Gray, in the *Catalogue of Edentate Mammalia in the British Museum*, 1869, places the animals which we are to consider here, under two sub-orders, and adds the Monotremes as a third; all being embraced in ORDER BRUTA. The latter term is the original Linnæan one for these forms. The teeth, as given by Gray in this connection, are of one or two kinds, all very similar, and they are often entirely wanting. The grinders are rootless. There are four free limbs—the toes being united in the skin to the claws, the latter compressed and elongate. The tongue is elongate, and the mammæ are pectoral or abdominal.

EXTINCT EDENTATES.

South America is nearly peculiar as the home of the Edentate animal. Individuals of this group are singular in appearance, quaint and extraordinary; and there is an unusual disparity in the aspect of the various genera and species. One is excessively *outré*, and another equally so in a wholly varied expression; and this characteristic is very forcibly exhibited in the strange gigantic remains opened to us from the fossil beds and ossiferous caverns of both the Old and the New Worlds.

Scanty remains of certain Edentates, that seem to be allied to existing Old World forms, are found in Europe. In the Miocene beds of Sansans, in France, and in Linz, were found remains of an extinct genus, which Cuvier regarded as related to the Pangolins. This form is called Macrotherium. Prof. Owen has since, with more material, announced his belief that it is more correctly placed between Manis and Orycteropus. Dr. Geibel thinks it is nearer the Armadillos. The latter determination would place the Old and New World forms nearer together than they have hitherto appeared to be.

The bone caves of South America have furnished forth most wonderful and numerous relics of this order, indicating an Edentate Fauna of great variety and enormous individuals. In 1789, a Spanish official sent from Buenos Ayres to Madrid a number of gigantic bones. Cuvier, after having examined them, found that a sufficient number were present to allow a satisfactory determination of their nature, and at once regarded them as portions of an Edentate, which has since been known as Megatherium. The head and shoulders, he thought, were like the Sloth, and the legs and feet like a mixture of characters peculiar to the Ant-eaters and Armadillos. Prof. Owen regards the creature as having had the same habits as the Sloths, on a larger scale; that is, it ate leaves and branches, and hung upon the inferior surface of the limbs of trees, as do the Sloths of the present day. An interesting discussion was induced concerning the probable method adopted by this enormous creature in securing its food. Cuvier and Agassiz assumed that it had a proboscis; but Owen showed that the anatomy of the nostrils did not provide for any considerable development in that direction. A rare chance furnished in one instance the hyoid bones of a specimen. Here was the secret: the extraordinary development of the hyoid region pointed to an unusual length and size of tongue; this, with the probable correspondence in development of lips, rendered the creature completely adapted to its surroundings. This species, the M. cuvieri, was larger than the Rhinoceros, measuring eighteen feet in length. The femur is three times the thickness of that of an Elephant. Another species of Megatherium was found in the Quarternary deposits of South Carolina and Georgia, called M. mirabilis.

The *Megalonyx* is another form of immense bulk, allied to the preceding; it is found in both hemispheres. President Thomas Jefferson first described the creature in the *Transactions of the American Philosophical Society*, 1799. The term which he adopted, Megalonyx, indicates the stout claws which distinguish the great beast. Dr. Wistar, of Philadelphia, placed it with the Sloths. Other specimens were subsequently found in the neighboring States. In Dr. Leidy's *Memoir on the Extinct Sloth Tribe*, this and other species are minutely described and most thoroughly illustrated. Megalonyx had been found in South America, represented by a few fragments of claws, etc., in the bone caves of Brazil. North American specimens were found in Virginia and in several of the Southern States.

Megalonyx dissimilis is another species, found in Natchez, Miss.

Ereptodon is an extinct genus, determined from a tooth found near Natchez; it is closely allied to the preceding.

Mylodon is another extinct genus, first described by Harlan, and the species is now in his name.

This was found in the Big Bone Lick, Kentucky. It is not so large as the Megatherium, yet it is gigantic, measuring eleven feet in length. It was closely allied to the Sloths of the present day, and had probably the same habits. The teeth are eighteen in number. Three species are already known: one from the Ashley River, S. C.; one as above, and the other from South America. Several other extinct genera are known in the Pliocene and Miocene of North and South America.

Scelidotherium has seven species in the Brazilian caves.

Cœlodon is found—one species—in the same localities.

Sphenodon, represented by one species, is in the same region.

Orycterotherium—two species—from the Miocene beds of Nebraska and South Carolina.

Gnathopsis has one species in South America; and another extinct genus from the same localities—the Brazilian caves—is called Ochotherium.

The MANIDIDÆ are not represented by fossil extinct species.

The DASYPODIDÆ, embracing the Armadillos, are represented by extinct species of Dasypus and Xenurus in the Brazilian caves. The following extinct genera are also found in the same localities, determined by fragments of jaws and various portions of other bones, viz.: Hoplophorus, Euryodon, Heterodon, Pachytherium and Chlamydotherium; the latter as large as a Rhinoceros.

Eutatis, allied to Tolypeutes, is from the Pliocene of La Plata.

ORYCTEROPODIDÆ is an extinct family, not represented in America. The extinct genus, Macrotherium, and the huge form of an extinct genus, Ancylotherium, are found in the Miocene of France and Germany.

MYRMECOPHAGIDÆ has one extinct genus, Glossotherium, in the caves of Brazil, and in the Tertiary of Uruguay.

The most remarkable forms allied to the Armadillos are the Glyptodon and Schistopleurum; the former having several species—some of them nearly reaching the size of an Elephant.

HOPLOPHORIDÆ is a term now used to embrace the latter forms. The word is from the Greek, indicating *armor-bearer*. They are most nearly related to the living Pichiegos (Chlamydophorus), and the Armadillos. The shell or carapace is a whole piece, as in the Turtles. They resemble gigantic Tortoises, some of them attaining a length of fifteen feet. The Glyptodon has become familiar to most observing visitors to scientific museums, through the admirable casts of the original specimen. This and the Megatherium and Mylodon, fortunately, were recovered in such a perfect condition that their mounted skeletons are practically nearly entire.

SUB-ORDER—TARDIGRADA.

Individuals of this sub-order have a short face, elongate limbs, simple pelvis, and are herbivorous.

FAMILY—BRADYPODIDÆ.

In this, the Sloth family, the grinders are without roots—are cylindrical; the canines distinct and acute. The body is covered with dry, crisp hair. The fore limbs are long; the tail very short or wanting; the mammæ are pectoral; the tongue is elongate. There are three genera. The Sloths are especially confined to the regions of the great forests of Brazil, Bolivia and Guatemala. None are found west of the Andes, nor do they extend into Paraguay.

CHOLŒPUS.—*Illiger.*

The hands in this genus are two-clawed; the feet are three-clawed. The front grinder is large, like a canine-tooth. The pterygoid bone is considerably rounded and vesicular. This is genus Bradypus of F. Cuvier.

UNAU, OR TWO-TOED SLOTH (*Cholœpus didactylus*).—This form is about two feet in length, and is found in Brazil and Guiana. Like other species, it is confined to the arboreal regions, where it progresses with great facility from branch to branch over immense forests. Its food consists of leaves, buds and fresh shoots.

HOFFMAN'S SLOTH (*Cholœpus hoffmanni*).—This is found in Porto Rico. The arms and claws are shorter than in the preceding.

BRADYPUS.

In this the hands and feet are three-clawed. The front grinder is small; the pterygoid is swollen, hollow and vesicular. The skull is flattened above on the forehead.

THE AI, OR THREE-TOED SLOTH (*B. crinitus*)—Plate 17, fig 55—is a native of Brazil. It is gray colored, with reddish sides; the back of the neck with a mane formed of elongate black hairs. It is more common than the preceding. The pelage of this creature is exceedingly curious, resembling hay of a soft kind. The structure of the arms and legs—the former being much the longest—is manifestly for facility in climbing, and this, too, upon the under side of the limbs of trees. Upon the ground, the Sloth is wholly at disadvantage, as he is not able either to stand or walk.

Another species of Bradypus is the B. affinis, also a native of Brazil.

ARCTOPITHECUS.

The hands and feet are three-clawed. The skull is rounded above on the forehead. The front grinders are small. The pterygoid is compressed, crest-like and solid. Five species are known in South America.

SUB-ORDER—EFFODIENTIA.

In this group the grinders are none, or rootless. The canines are sometimes entirely wanting; if

present, they are like the grinders. The face is elongate; the mouth mostly small. The body is armed with scales, spines, or rigid hairs. The limbs are short and strong; the hinder ones the longest. The stomach is simple; the malar bone simple, or wanting. The family *Manididæ* is not found in America. The next is

FAMILY—DASYPODIDÆ.

The dorsal disks are closely attached to the back of the animal. The pelvic shield is free from the pelvis. The feet are strong; the hind-toes free; claws, large. The tail is elongate.

TATUSIA.

This genus has five to eight central rings; four to five toes. It has no cutting-teeth, and has eight grinders on each side.

PEBA, OR TATOUHOU (*Tatusia peba*)—Plate 17, fig. 56.—This is native in Guiana and Brazil, about thirty inches in length. It is a quiet, harmless creature, formed for burrowing, and inhabiting the great open plains of the country. In common with its relatives, it has a curious faculty of rolling itself into a ball, nearly concealing its limbs and head. Their food is partly animal and partly vegetable. Mr. Darwin alludes to their habit of digging with surprising rapidity, "nearly getting out of sight before one can dismount." This species is found, also, in Central America, where it is called the Texan Armadillo. It is esteemed a luxury in this region. Three other species are known to South America, one about the size of a Rat.

PRIONODOS.

This genus has the three or four front rings of the scapular shield deeply divided; free when young. The central rings are numerous. It is plantigrade. The teeth are $\frac{3}{24}$–$\frac{3}{24}$, small; the intermaxillary toothless. One species is known—the TATOU (P. gigas). Habitat, Paraguay and Brazil.

DASYPUS.

The head is broad, covered with large plates. A series of small shields are under the eyes. The frontal plate is large and broad. Central rings, six to eight in number. The teeth are $\frac{9}{10}$–$\frac{9}{10}$; the first upper in the intermaxillary. The Dasypus sexcinctus, and a new species, D. vellerosus, are all that belong to this group. Both are from Brazil and Paraguay.

EUPHRACTUS.

The head is conical, covered with a shield of many polygonal plates, and with a tuft of hair under the eyes. A narrow, strong band of plates is on the neck. The dorsal disk is very hairy. The toes are 5–5. The claws are acute and triangular; the front one the largest. The teeth are $\frac{8}{9}$–$\frac{8}{9}$; moderate in size.

THE PEGHY (E. minutus), and PELUDO (E. villosa), are South American.

XENURUS.

Head is elongate. The scapular and pelvic shields are convex. The central rings, ten or eleven in number. Toes, 5–5; teeth, $\frac{8}{9}$–$\frac{8}{9}$; no intermaxillary teeth. Two species are known, viz., unicinctus and hispidus. Both are from Brazil.

FAMILY—TOLYPEUTIDÆ.

In this family the dorsal disk is only united to the body by the centre of the back, free from the hairy skin on the sides. The scapular and pelvic shields are large, convex, and separated by three free central rings. The feet are weak; the front with elongated and unequal claws, the tips of which are placed upon the ground when the animal walks. The hind-feet are club-shaped, with flat, ovate nails; the palms and soles are covered with plates. The tail is short. The skull is attached to the frontal shield by two or more bony prominences. The animals have the power to bend the body into a complete sphere.

TOLYPEUTES.

The head in this genus has a flat frontal shield, the hinder edge being prominent. The ears are granular. The tail is conical, the base broadly expanded. There are four toes before and five behind; the hind-feet are small; the toes indistinct, united. Teeth are large. The under side of the body is covered with long bristly hairs. The males are rather longer in shape than the females. The genital organs of the males are very large. These animals are very active. The native Brazilians call them Tatu bola. Geoffroy, in *Compt. Record*, 1847, uses the term Apar as the generic name. Cheloniscus is another synonym.

APAR (*Tolypeutes tricinctus*).—This is Dasypus tricinctus of Linnæus; D. apar of Desm.; Tatusia apar of Lesson; and Apar of Buffon. It inhabits Bolivia and near Buenos Ayres. The frontal shield is flat and broad, and the hinder margin regularly arched. The skull has a bony prominence over each orbit for the attachment of the shield.

Tolypeutes cornutus, called MATACO, has four front claws, the middle one very strong. This is otherwise similar to the first; its habitat is the same. A specimen of this species was kept in the Zoölogical Society's Gardens, where its habits were observed. "It slept rolled up, with its head downwards."

Dr. Gray adds here the family *Glyptodontidæ*. We have previously treated of the extinct forms under the appropriate head. Gray states the matter in these terms, viz.: "*Glyptodontidæ*—Dorsal shield entire, not revolute, immovably fixed to the upper part of the very large pelvis. Genera: (1) Glyptodon, *Owen;* (2) Panocanthus, *Burm.;* (3) Hoplophorus, *Lund.* (Schistopleurum, *Nodot.*)"

FAMILY—CHLAMYDOPHORIDÆ.

The dorsal disks are divided into two parts behind, forming an elongated dorsal and short pelvic

shield; the latter is attached to the bones of the pelvis. Two genera are known.

CHLAMYDOPHORUS.

The dorsal shield is attached only to the middle of back; the sides of the back under the shield, the under side of the body and limbs covered with silky hairs.

PICHICIAGO (*C. truncatus*)—Fig. 51, vol. i, p. 152.—This strange form is an inhabitant of Chili. It unites to the characters of its allies, those of the Mole to a certain extent, its large claws suiting its fossorial habits. It is rare, even in Chili, and is seldom seen in collections. The creature looks like an artificially made-up object, as if it may have been carved in stone. Its posterior is abruptly truncated, and the back covered with a series of plates of armor, similar to those of the Armadillos; this covering is loose, excepting along the dorsal ridge and top of the head. It is considered to be nearer the Megatherium than any living species. Dr. Harlan, who first described this creature, says: "We here present a *new form*, an animal combining in its external configuration a mechanical arrangement of parts which characterizes, respectively, the Armadillo, the Sloth, and the Mole; constituting in themselves, individually and separately, of all other quadrupeds, those which offer the most remarkable anatomical characters." The natives of the country call it the Blind Armadillo. Mendoza is the exact locality of its habitat; it does not extend over the Andes. Burmeister found a second species, which is now placed in another genus, as follows:

BURMEISTERIA.

This genus is distinguished by the dorsal shield being attached as far as the edge to the skin of the back. The pelvic disk and the tail are only covered partially with tesseræ, or square plates; the sides and under parts covered by woolly hair.

Burmeisteria retusa is the only species. It has the plates of the dorsal shield with one or two bristles on the hinder edge; those on the sides of the back with many bristles on the lower edge; the upper part of the pelvic disk with pencils of bristles. It was formerly described by Burmeister as Chlam. retusus. It is larger than the preceding, which is about the size of a large Rat. Its habitat is Bolivia and Santa Cruz de la Sierra.

Dr. Gray introduces the *Orycteropodidæ* as the next family. None of these forms are found in America. The Aard-Vark is the typical species. Habitat South Africa, three species being known.

FAMILY—MYRMECOPHAGIDÆ.

The body is covered with hair. The head is conical, elongate, with small mouth. Teeth are absent. Cuvier called the group *Edentata gennina*. The ribs are flat, more or less dilated externally; in Cyclothuri the ribs overlap from this cause.

MYRMECOPHAGA.

In this genus the toes are 4–5. The palatine and pterygoid bones are united beneath the nasal canal for its whole length. The fur of the body and tail is elongate and flaccid. The tail is extremely bushy. The skull is remarkably long and slender. One species only is known.

GREAT ANT-EATER (*Myrmecophaga jubata*).—Plate 17, fig. 57.—This singular creature is also called TAMANOIR and ANT-BEAR. It is the largest of living Edentates, measuring nearly seven feet in length, inclusive of the tail, which is about two and a half feet. The tail is a most wonderful feature, flowing like a fountain plume of great dimensions over the entire body of the animal. It is plantigrade, yet the curved claws render locomotion uncomfortable for any extended action. Its habits are slothful and solitary; and it sleeps during a great portion of the day. Its food consists of Ants, principally; its powerful claws serve to open the Ant-hills, while its long and flexible tongue serves to collect them. The great size of the creature suggests a comparison with the seemingly ignoble nature of its prey; but when the enormous quantities of insects that congregate in tropical countries is taken into account, we readily see the wisdom of the relationship. They are not numerous. The female has only one cub at a birth, which clings to the back of the mother even after it can shift for itself.

TAMANDUA.

The toes in this genus are 5–4. The palatine and pterygoid bones are united beneath the nasal canal for the whole length. The fur is short and bristly. The tail is prehensile. Strictly arboreal in habits.

THE COLLARED TAMANDUA (*T. bivittata*).—This resembles the preceding, excepting in the shape of the tail and in size, the present being about one-third the bulk of the Tamanoir. It is more active than the latter, and finds a home in the thickest forests. It feeds on insects, and is said to be fond of wild honey. Its habitat is in Brazil and Paraguay.

The *T. longicauda*, or YELLOW TAMANDUA, is similar to the present, but has longer tail and a lighter-colored pelage. The ears are large and rounded, and there is no mark upon the shoulder that distinguishes the other.

CYCLOTHURUS.

The toes in this genus are 2–5, the outer front one much the largest. The pterygoid bones meet, and present two long, parallel, and little prominent crests. The skull is short and broad. The ribs overlap each other from the great expansion of the exterior edges.

THE LITTLE ANT-EATER (*Cyclothurus didactylus*).—This little form has a highly prehensile tail; hence the generic term, meaning twisted-tail. It is a native of tropical America, inhabiting the dense forests. Like the preceding, it is nocturnal in habit, sleeping during the day, with its tail enclosing the

limb of a tree. It is said to have some of the habits of Squirrels, being more lively than other forms of the order. The fore-feet have two claws only; the exterior one is much the larger. The eyes are very small, and the ears are hidden in the fur. The whole animal is covered with a rich, soft and curly fur of a pale yellow-brown color.

The *C. dorsalis* is a second species, found by Mr. Salvin in Costa Rica. It is known by the "distinct, well-defined, broad dorsal streak, and the yellow color of the feet and tail." Its general color is a golden-yellow. There are four mammæ, yet only one young is produced at a birth.

EXTINCT FOSSIL UNGULATES

Under this head we arrange the numerous extinct forms which are not only allied to the Ruminants, but have a close relation to those embraced in the more comprehensive term—UNGULATA. The latter designation is used by later writers, as embracing in one order the Horses and all hoofed animals. In the Post Pliocene deposits, remains of Bos, Equus, Antelope, Hippopotamus, Rhinoceros and Phacochœrus are found. Equus is represented in the Pliocene; and, for the first time, Hipparion, a horse-like animal, in which the small lateral toes, seen in other forms, appears. Both genera occur in Europe. The genus Tapirus is found in the Newer Pliocene of France, and in the older beds of France and England; Rhinoceros, Hippopotamus and Sus appear in the same. The genus Cervus is seen represented in great numbers in this period. Eight species are found in England; Antelopes, Oxen and Bison are represented in the same. The most notable example of *Cervidæ* is the great Irish Elk (*Cervus megaceros*). Remains of this animal are found in the Irish bogs. There are numerous quite perfect specimens of the skeleton in the museums; one in Central Park has a breadth of antlers reaching nearly eight feet. A specimen in the British Museum measures ten feet in width across the antlers.

In the Miocene of Greece the three-toed Hipparion is represented, as well as three large species of Rhinoceros, and one species of the extinct genus Leptodon. Remains of a very large Wild Boar were discovered here; and among these remains were also a species of Giraffe and an extinct genus, called Helladotherium. Antelopes were represented by extinct genera Palæotragus, Palæoryx, Tragoceras and Palæoreas. An ancient form of Cervus is seen in an extinct genus, named Dremotherium. In the Miocene of Europe, the Ungulates were represented by Hipparion and Anchitherium.

TAPIRIDÆ.—Paloplotherium is an extinct genus of the Tapir family, found in the Eocene. Hippotherium is allied to the latter. Tapirs, allied to living forms, are found in the Vienna Basin. In the same locality and period are also Rhinoceros and the four-toed hornless species, called Acerotherium. Swine are numerous; and extinct genera Hyotherium, Palæochœrus and Chœromorus, Hyopotamus and Anthracotherium, are also here—the latter, according to Prof. Leidy, the type of a distinct family. Listriodon is regarded as allied to the Tapirs.

THE ANOPLOTHERIIDÆ are members of an extinct family allied to the Swine, and with some relationship to the Camels. The genus Chalicotherium, a large creature of the size of the Rhinoceros, is represented by three species in Germany and France. An extinct genus, Synaphodus, is allied to the preceding.

AMPHIMERICIDÆ.—This extinct family is also known under the title *Xiphodontidæ*. It is represented in two genera—Cainotherium and Microtherium. These were small, and intermediate between the Swine and *Tragulidæ*. The Giraffes were represented by the gigantic Helladotherium, and the *Tragulidæ* by the extinct genus Hyomoschus.

CERVIDÆ.—The Deer, seemingly, were not known until the Upper Miocene Epoch. They were then represented by Dorcatherium and Amphimoschus. The true Cervus is also found here, with the allied forms, now extinct, Dremotherium, Amphitragulus, Micromeryx, Palæomeryx and Dicrocerus.

BOVIDÆ were not largely represented in Miocene times. There were no Sheep, Goats, nor Oxen.

EQUIDÆ were present in the Eocene Period of Europe; represented by the extinct genus Anchitherium, and a more ancient form named Anchilophus.

TAPIRIDÆ and PALÆOTHERIDÆ were very numerous in species. Paloplotherium was abundant. These have affinities with the Horse, Rhinoceros, Cadurcotherium, Lophiodon and Propalæotherium; Pachynolophus and Plagiolophus are also allied. The latter Mr. Huxley regards as the legitimate ancestor of the Horse. Other forms are Coryphodon, Pliolophus and Hyracotherium, Tapir-like animals, somewhat resembling the Horse. Swine are represented in the Eocene by several small extinct genera.

ANOPLOTHERIDÆ were numerous. Of this extinct family, the Anoplotherium is the type. It was two-toed, and had a long tail. A four-toed form is called Erytherium.

THE EXTINCT UNGULATES OF THE NEW WORLD.

Vast beds of fossil extinct animals have been discovered in the desert regions of North America, called the "Bad Lands," or Mauvaises Terres of the French settlers. Dr. Leidy, after visiting the localities, where he brought to light an immense amount of material, describes a portion of the country as a wide plain, at the base of the Uintah Mountains, at an altitude of nearly seven thousand feet above the level of the ocean. This plain, at the close of the Cretaceous Epoch, was probably a vast fresh-water lake, and a rich tropical vegetation, no doubt, covered its banks. It is thought that the country has since undergone slow and gradual elevation, sufficiently to drain its waters and leave the surface dry land. The "Bridger beds," so called from their proximity to Fort Bridger, in the great Uintah Basin, are in

the form of terraces or table-lands, consisting of nearly horizontal strata, variously colored indurated clays and sandstones. Through atmospheric agencies the beds are worn away, and the embedded fossils fall with the crumbling masses. Dr. Leidy says, in viewing the vast piles of broken terraces that compose the "Bad Lands": "The utter desolation of the scene, the dried-up water courses, the absence of any moving thing, and the profound silence which prevailed, produced a feeling that was positively oppressive. When I thought of the 'buttes' beneath my feet, with their entombed remains of multitudes of animals, forever extinct, and reflected upon the time when the country teemed with life, I truly felt that I was standing on the wreck of a former world." This region has already become classic ground to the palæontologist.

THE EQUIDÆ are here represented by six species of Horses, and one of Hipparion. In the Tertiary, Pliohippus and Protohippus are known. These all have the lateral toes developed, but they are not serviceable. Anchippus, Merychippus and Hyohippus are related to the European Hippotherium. These are very small, being only about two and a half feet high.

ANCHITHERIDÆ is the name of a family of extinct forms, resembling the Horse. The lateral toes in these are so developed that they are used in locomotion. Anchitherium, as previously recorded, is found in Europe, as well as in America. A species is named A. bairdi. Four others are enumerated. The extinct genera Miohippus and Mesohippus embrace certain Horse-like animals, about the size of a Sheep, each having three toes on each foot. Several species, about the size of a Fox, have been found in the Eocene of Utah and Wyoming. These have four toes before, and three behind. The last-mentioned are included in the genus Orohippus.

Palæosyops is an allied form, belonging to the same family as the preceding, represented in the Eocene of Wyoming by four species. Lymnohyus has one species. Hyrachyus is an extinct genus of odd-toed Pachyderms, found in the same locality; it is closely related to the tapiroid genus Lophiodon; also, in a less degree, with the Rhinoceros-like Hyracodon. Several species are known in the Eocene. Lophiotherium is an extinct genus of tapiroid Pachyderms, closely allied to Lophiodon. A form of odd-toed Pachyderm, which is regarded as very curious, is Trogosus, an extinct genus; it was about the size of a living Peccary. It had no canines, and was provided with a large pair of incisors, like those of a Rodent. It is called T. castoroidens, or the "Beaver-toothed Gnawing-hog."

Hyopsodus is an extinct genus, including the smallest of Pachyderms; and Microsyops is another of the same size. Elotherium has three species; and Dicotyles is represented by one species.

CAMELIDÆ, embracing the Camels, is one of the most numerous families on the American continent, in so far as relates to extinct genera and species. The genera Auchenia and Procamelus, the latter with several species, are known. An extinct genus —Palauchenia—found in Mexico, was about the size of the living Camel of the Old World. The species Auchenia californica exceeded it in size. The extinct genus Procamelus was found in the Miocene of Virginia. Megalomeryx is an extinct genus, allied to the preceding. Homocamelus is from the Pliocene. In the Miocene are found the extinct genera Pœbrotherium and Protomeryx, the former allied both to Camel and Llama.

BOVIDÆ are represented by Bison latifrons, and three others, in the Quarternary of California and Pennsylvania, and in other (Southern) States; and by an extinct genus—Casoryx—which is thought to be intermediate between the Antelope and Deer. The Musk Ox—Ovibos—is represented by an extinct species in the Diluvium.

CERVIDÆ.—The Deer have representatives in the extinct genera Leptomeryx and Merycodus; the latter resembling the Camels, as well as Deer. The extinct genera Hypisodus and Hypertragulus, very small individuals, are allied to Tragulus and Leptomeryx. Several extinct species of Cervus are also found in the same deposits—the Miocene of Wyoming.

CAPRIDÆ are seen in the Pliocene. One extinct species—the mammilaris—is known.

LIMNOHYIDÆ.—This is a family of animals, about the size of Sheep. Limnohyus is the type, and Colonoceras is of the family. The nose of these forms had horny protuberances on the upper surface. The wonderful genus Bathmodon, five species of which have been described, from the Eocene of New Mexico, is regarded as forming the type of a new family.

RHINOCEROTIDÆ.—This family was represented in these ancient times by Rhinoceros in the Pliocene and Miocene, and by Aceratherium and Hyracodon in the Miocene. In the Eocene and Miocene of Utah and Oregon, several wonderful extinct Rhinoceroses have lately been found; they form the genus Diceratherium. There were two horns on the snout, side by side. They were not so large as the living forms. Allied to these was the extinct family

BRONTOTHERIDÆ.—Certain of these forms exceeded in bulk the largest living Rhinoceros. Dr. Leidy and Prof. Marsh describe the extinct genera Brontotherium, Titanotherium and Megacerops and Anisacodon. Another remarkable genus is Symborodon, from the Miocene of Colorado; it has seven species, one of them having nearly the bulk of an Elephant. The latter is thought to have had a proboscis. Peccaries are found in the Pliocene of Nebraska and Oregon; and an allied form, called Thinohyus. The Miocene exhibits allied genera Nanohyus, Leptochœrus and Perchœrus.

ANTHRACOTHERIDÆ, a family which connects the ruminants with the Hippopotamus, and which is known in the Miocene of Europe, is represented in America by Hyopotamus in the Miocene of Dakota, and by Elotherium in the Miocene of Oregon and the Eocene of Wyoming. The latter has lately been placed, by Prof. Marsh, in the extinct order *Tillodontia*.

LIMNOTHERIDÆ.—In the Eocene of New Mexico are several genera of extinct forms, allied to the

present family, viz.: Meniscotherium, Palæosyops and Hyopotamus. Other forms are: Phænacodus, the size of a Hog, allied to Elotherium and Achænodon, about the size of a Cow, but Hog-like in aspect. Pelonax is another form, between Hippopotamus and Elotherium.

OREODONTIDÆ.—This wonderful family is strictly an American one. Dr. Leidy applies the term "ruminating hog" to the individuals. They were abundant during the Pliocene time, and especially so in the Miocene. They were like, in some respects, the Camel and the Deer. Six genera and twenty species are recorded. The genus Merychus is from the Pliocene.

The Miocene forms are Oreodon, Eporeodon, Merychochœrus, Leptauchenia and Agriochœrus. The latter is as far back as the Eocene, and is like the European family *Anoplotheridæ* of the same epoch.

In the Brazilian caves, the extinct Ungulates are mostly of the Post Pliocene and Pliocene deposits; a few are referred to the Eocene. Dr. Lund has given to science a vast amount of material relating to the extinct Fauna of the deposits. In the province of Minas Geraes, near the headquarters of the San Francisco River, are limestone caves. Dr. Lund visited thousands of them. Sixty only gave evidence of having bones in them. In our notice of fossil *Ursidæ*, previously given, will be found an account of the contents of these caves. It is estimated that several thousands of years must have elapsed since they were thus choked with such osseous masses. Some of the remains are of living species, but the major part are extinct. Stone implements and human remains were found in some of them. There were the extinct and living genera Leptotherium, Antelope, Equus, Tapirus, Dicotyles, Auchenia and Cervus. Equus and Antelope are not known in South America.

In the Pliocene Period of South America there were two species of Equus, two of Macrauchenia, allied to Tapir and Palæotherium. These had long necks, and were of the size of the Camel. In Patagonia an extinct genus has been found, and burdened with the designation Homalodontotherium. This is believed by Prof. Flower to be allied to the Rhinoceros, but still more to the Miocene Hyracodon of North America. It also resembles the extinct genus Macrauchenia. The extinct genus Nesodon is allied. In the deposits of the Pampas there is an extinct species of Dicotyles. Auchenia is represented by three extinct species in Bolivia. There are two extinct genera in the same formation—Palæolama and Camelotherium. Three species of Cervus are found in the same.

In the Eocene of South America, the Horses (Equus) were largely represented; and the extinct genera Palæotherium and Anaptotherium, common in the European Tertiaries, are found in the same deposits as those of the Pampas.

ELEPHANTIDÆ.—Several species of Elephas and Mastodon, or allied forms, are found in the Tertiary deposits. Elephas primigenius—the MAMMOTH—is a notable example. The variety americanus is found in North America. One other species is recorded from Mexico, Georgia and Alabama.

The Mastodon is represented in South America by two species; and in North America by two species—M. giganteus and M. mirificus; the latter from Nebraska.

The Middle Eocene of Wyoming and Colorado has yielded, through the agency of Dr. Leidy and others, a series of most wonderful remains, which have proved of such exceptional importance, as strange forms, that a separate and new order has been constructed for them.

DINOCERATA.—Wallace says: "This new order consists of animals with generalized Ungulate and Proboscidean affinities. The lower jaw resembles that of the Hippopotamus. They had five toes on the anterior feet, and four on the posterior; three pairs of horns, the first pair on top of the head, large, and perhaps palmated, the second above the eyes, while the third and smallest stood out sidewise on the snout. They had enormous upper canines, of which the roots entered the middle horn cores; no upper incisors, and small molars." Four genera are recognized, namely: Dinoceras, the typical one, with three species; Tinoceras, two species; Uintatherium, one species; and Eobasileus, two species.

TILLODONTIA is another new order, and established by Prof. Marsh, combining the characters of *Carnivora*, *Ungulata* and *Rodentia*. Two families are formed, the *Tillotheridæ* and *Stylinodontidæ*, which embrace three genera—Tillotherium, Anchippodus and Stylinodontia. All are from the Eocene of Wyoming and New Jersey. The animals were rather small in size, ranging between the Tapir and Capybara. The skull was somewhat like that of the Bear. The molar-teeth were like those of Ungulates, and the incisors like those of Rodents. The feet were plantigrade, and the whole skeleton is said to be Bear-like. Three new genera, allied to the preceding, found in the Eocene of New Mexico, have been named Ectoganus, Calamodon and Esthonyx. They have, according to Cope, some relation with the South American *Toxodontidæ*. A most wonderful group of extinct animals is that bearing the latter name; some of them, it is said, rivaling even the huge Megatherium in size. Toxodon and Nesodon are the genera, and several species are found in the deposits of the Pampas and Patagonia. They are allied to the Ungulates, Rodents, Edentates and the aquatic Sirenia.

SOLIDUNGULA.

EQUIDÆ—The Horses.—America has no living species of this family, but numerous fossil extinct forms, of great interest from their varied organization. One genus and eight species are now recognized as the "*personnel*" of the order. Reference to the chapter on Palæontology of Ungulates will show the great numbers of this order which inhabited this continent in ancient times.

UNGULATA.

FAMILY—TAPIRIDÆ.

Wallace records two genera and six species of the Tapir family. For a long time only two species were known—the Malayan and the American. Lately several forms have been discovered in South America; and some authors claim that even four species are known to that region. These are all found in the Andes of New Granada and Ecuador, at an elevation of eight to twelve thousand feet. One species, or, as some have it, two, of the allied genus Elasmognathus, has been found in Central America, and from Panama to Guatemala.

The term Tapir is from the Latin, *Tapirus*, which is a modified form of the original Brazilian. These animals closely resemble the Swine in form, yet are not so nearly allied to them as is usually supposed. They are Ungulates of the Perissodactyle group, and are closely related to the Rhinoceroses and Horses. They are characterized by having the hind-quarters project conspicuously backwards. The snout is produced into a flexible rudimentary proboscis. The ears are erect, and developed moderately. The neck is short, and the tail also. There are four toes on the fore-feet, and three on the posterior. The dental formula is: Incisors $\frac{3}{3}$; Canines, $\frac{1}{1}$; Premolars, $\frac{4}{3}$; Molars, $\frac{3}{3}$.

TAPIRUS.

The Tapirs, and another form found in India—the Rhinochœrus—have the margins of the upper jaw rolled inward. "The Elasmognathi have them spread out so as to firmly embrace the meseth-moid." They are all inhabitants of wet lands, where water is abundant.

The Tapir does not take water through the snout, but raises that organ as it drinks by the mouth. One young only is born in a season, from one individual. The Tapir seems to be quite easily domesticated. Cuvier gives some details of the tame animal. He says it was gentle and confiding, and appeared to have no will of its own. It seemed to seek the company of other animals in an unusual degree.

THE COMMON AMERICAN TAPIR (*Tapirus terrestris*)—Plate 25, fig. 82.—This species is found in all parts of South America, from the Straits of Magellan to the Isthmus of Darien. It is regarded as the largest of South American mammals, measuring sometimes six feet from the nose to tail. It is nocturnal in habit, and selects one mate only. This is the T. americanus of former authors.

Tapirus pinchaque is a species confined to the Andes of South America, especially in Ecuador and New Granada. This is the T. villosus, or Roulins' Tapir, of authors. Its habitat is quite circumscribed, as we have seen. Gray gives it as "The Cordilleras."

ELASMOGNATHUS.

Gray, in *Brit. Mus. Cat.*, 1869, gives the characters of this genus as follows: "The internasal cartilage ossified nearly the whole length, the bony part produced beyond the end of the nasal."

BAIRD'S TAPIR (*Elasmognathus bairdii*)—Plate II., fig. viii.—The specific characters of this species are a very short fur, close, and dark brown in color, or nearly black. The lower parts of the cheeks and sides of the neck, bay-brown; chin, throat, chest, and front edge of the shoulders, grayish-white.

The figure of Baird's Tapir referred to is that of a young one, which shows the peculiar stripes that accompany the young. It is said that this species is easily distinguished from others by its white chest, and bay cheek. This is the only species of the genus known. It is native of the Isthmus of Panama, and extends northward into Mexico.

Another form, which is regarded as somewhat doubtful as a true species, is the E. dowii. The E. bairdii is thought to be the largest of American species.

Tapirs were largely represented in Eocene times in both countries; and they are allied to the extinct family of *Lophiodontidæ*.

RHINOCEROTIDÆ is the family which Wallace places here to follow the Tapirs. The Rhinoceros is the only living genus represented, with nine species. As we have seen, there are numerous extinct forms in both continents—the hornless Acerotherium, and the Leptodon, and the curious Hyracodon of our Western deposits, the Miocene of Nebraska. More than twenty species of extinct Rhinoceroses are known.

HIPPOPOTAMIDÆ are represented by one genus and two species. Eight distinct species are known, but none in this country.

FAMILY—SUIDÆ.

Wallace records five genera and twenty-two species of Swine-like animals; and he adds: "The Swine may be divided into three well-marked groups, from peculiarities in their dentition. (1) The *Dicotylinæ*, or Peccaries, with one genus; (2) the true Swine, three genera—Sus, Potamochœrus, and Babirussa; and (3) the *Phacochœrinæ*, or Wart Hogs."

The Peccaries—two species—are those that claim our notice, being indigenous to the American continent.

THE COLLARED PECCARY (*Dicotyles torquatus*)—Fig. 74, vol. 1, page 190.—This animal has the general appearance of a Hog. It is peculiar to South America and Mexico. It is a gregarious animal, and, in its wild state, is exceedingly fierce and dangerous. The Cougar and Jaguar are said to meet a very determined antagonist in this little creature. Its flesh is somewhat esteemed, though a dorsal gland, which secretes a disagreeable fluid, renders it a doubtful species of game. The Mexicans call it TAJAZON. Its habits are similar to common Swine.

WHITE-LIPPED PECCARY (*Dicotyles labiatus*).—This species is called by natives TAGNICATE. It is almost double the preceding in size and weight. It is highly gregarious, differing in this respect from the other; and, in large troops, they traverse great distances. The White-lipped Peccary is exclusively a South American animal.

ORDER IX.—RUMINANTIA.

THE Ruminating Animals, embraced in this order, are regarded as forming one of the most clearly defined groups of the animal kingdom. The classification adopted by late writers is more or less founded on the plan indicated by Prof. Owen, which exhibits as sub-orders *Artiodactyla*, *Perissodactyla*, *Proboscidea*, and the extinct *Toxodontia*, under the order *Ungulata*. As the present matter is additional, or supplementary to the main portion of this work, the sequence and form of orders as are therein seen will be observed. On page 7, Vol. I., will be found a table which shows this arrangement. Section B is that of the UNGULATE or HOOFED ANIMALS, embracing orders *Ruminantia*, *Solidungula*, and *Pachydermata*, which include the same forms found in the sub-orders above-named.

Several important features of structure characterize individuals of this order. The feet are bifid, each phalange being terminated by a distinct hoof. All but the Camels are destitute of cutting-teeth in the upper jaw. The stomach is compound, the structure and functions of which are among the most important characteristics. Four different compartments are seen, each having certain offices, one exception only being known—that of the Camel, which has three stomachs. The presence of horns is another constant feature, with some exceptions. These are variously developed in the Sheep, Oxen, etc. They are solid protuberances from the skull, covered by a hollow sheath, which remains during the life of the animal. In the Deer and Antelopes—with the single exception of the Giraffe, which has rudiments or knobs that are persistent—the horns are solid, and fall periodically. Two divisions are, consequently, made in the order—the *Hollow Horn* and the *Solid Horn* Ruminants. Three very natural groups are also recognized; two as above designated, and a third, which includes the Camels and Llamas—those having no horns.

The operations of rumination and digestion are somewhat complicated in this order. Of the four stomach divisions, the first is called the *rumen*, or paunch; this receives the coarsely chewed food. The second compartment, or stomach, is curiously formed to hold, by numerous little purses or pouches, the water taken in. It is called the *reticulum*, from its *purse*-like character. The water is gradually mixed with the coarsely-divided food, which is undergoing a certain process in the *rumen*, resembling mastication. When this has advanced to a sufficient pulpiness, a portion is received into the muscular canal, at the termination of the œsophagus. It is there moulded into a ball, and propelled, by an inverted action of the muscles of the gullet, into the mouth, passing, as is seen, over the same ground that it occupied in the first instance of swallowing in the crude form; that is, while the creature is grazing. Here, in the mouth, it is masticated and mixed with the saliva, and then swallowed, to go directly into the third stomach, called the *psalterium*, from the broad, leaf-like processes of membrane which line the interior. Certain absorption here takes place, and the mass passes on to the fourth compartment, or true digesting stomach, called the *abomasus*. From here the usual phenomena of digestion proceeds.

The eyes of Ruminants are placed on the sides of the head, that they may command an extended vision while grazing. Their ears, also, large and movable for protective purposes. The sense of smell is particularly active. The importance of these animals to mankind is too apparent to require notice here—their flesh as food, every portion of their bodies, their hides, blood, horns, hoofs, tallow, and their milk. Indeed, so many and various are the products, one may well regard these creatures as special objects for man's welfare. From the earliest times they have been domesticated, and they have always accompanied man throughout his nomadic career.

FAMILY—CAMELIDÆ.

This family is represented in South America by one genus, Auchenia, with four species. Wallace enumerates two genera and six species in all. This leaves the Bactrian Camel of Asia, and the Dromedary, or Common Camel, of both Asia and Africa. In our account of the extinct *Camelidæ*, it is seen that this family was at one time very abundantly represented in North America.

THE LLAMA, OR GUANACO (*Auchenia glama*) Plate 23, fig. 75.—This is a somewhat familiar animal, through the specimens frequently placed in menageries and our zoölogical gardens. it is much like the Camel, though very much smaller. Its size is about that of the Virginia Deer. In the wild state the hair is exceedingly long, and it is used extensively, in the form of guanaco, for manufacturing purposes. The Llama is seen in great numbers in a more or less domesticated state. Great numbers are used for burden and traffic. It requires little care, and is like the Camel in its endurance of thirst. The voice resembles the neighing of a Colt. When annoyed by any one approaching, it discharges a quantity of saliva at the intruder. This we have witnessed in the Central Park collection. Peru is the region most inhabited by the Llamas. They frequent the coldest portions of the mountainous regions.

The PACA is found in similar localities. It differs in having tawny, brown-colored hair, which hangs in very long pendant masses, furnishing the much-prized alpaca wool.

The VICUNA is the smallest species, being about the size of a Sheep. It is more elegant in shape, the legs being longer in proportion, and more neatly

formed. Its eyes are large and intelligent. The fleece surpasses in fineness and softness any other known. Some attempts are being made to acclimatize these creatures, in order to procure their wool without sacrificing so many. The ancient Peruvians made use of the Llamas for various purposes, particularly for beasts of burden. They prove, even in these days of steam, most valuable for carrying over the mountain passes of the Andes. It is said that they easily carry a hundred and sixty pounds weight. Their flesh is esteemed as food. The range of these animals is from Peru to the Straits of Magellan.

TRAGULIDÆ—the Antelopes—are placed here, with two genera and six species, as restricted in Wallace's arrangement. All are of the Old World. The allied American forms are placed in another group.

FAMILY—CERVIDÆ.

THE DEER.

Wallace enumerates in this family eight genera and fifty-two species. They are found very generally distributed, excepting in Africa, where they are restricted to the Mediterranean region. Of our American species the genus Alces has one, and Tarandus one (or two). Forty species of Cervus are enumerated. The typical Deer have antlers, in the male, and in one instance—the Reindeer—the female has them. The Musk-deer have none. Members of this family have deciduous horns, which are solid, and are developed from the frontal bone. The antlers, as the horns are usually called, are more or less branched. In the growing state, from the time of the first putting forth of the new antlers, there is a soft velvety integument, which covers the surface in which the nutrient blood-vessels lie. When the antlers are perfect in growth, the velvet is rubbed off by the animal, and the channels which held the blood-vessels remain visible upon the surface. The circulation of the great vessels that accompany the growing antler is eventually stopped by a timely growth of tubercles around the base of the antlers; these so press upon the vessels that coagulation takes place; the blood ceases to flow, and the velvety integument becomes dead, extraneous matter, and yields to the process of rubbing.

The dental formula of *Cervidæ* is: Incisors, $\frac{0}{3}$–$\frac{0}{3}$; Canines (usually), $\frac{0}{1}$–$\frac{0}{1}$; Premolars, $\frac{3}{3}$–$\frac{3}{3}$; Molars, $\frac{3}{3}$–$\frac{3}{3}$.

ALCE.—*Ham. Smith.*

In this genus the muzzle is broad and much elongated. The neck is short and thick.

MOOSE (*Alce americanus, Jardine*).—This remarkable animal was called by the earlier writers Cervus, and the present generic term Alce was used as its specific designation. The various terms Moose Deer, Black Elk, Flat-horned Elk, and Black Moose are used in different sections of North America. The Moose is regarded by late writers as identical with the Swedish Elk. Its range is now confined to the northern regions; occasionally it is seen in the northern parts of New York and Maine. The antlers of the Moose are most remarkable; their wide palmate surfaces spread to such an extent that an enormous weight is sustained. The neck is correspondingly developed. Unlike most ruminants, this creature has a short neck, one seemingly unfitted for grazing. As a compensation, the mouth is constructed for eating the limbs of trees, and to this end the lips are very mobile and elongated. The term Moose is an Indian one, from *musee*, meaning wood-eater, in reference to its habits of grazing bits of shrubs and trees. The "Moose wood," or Pennsylvania maple (*Acer Penn.*) derives its name from the fact that the Moose feeds off it. In winter these animals congregate in small droves, and occupy a space which they keep tolerably habitable by tramping the snow. Their movements are very rapid, moving through the thickets with wonderful ease and caution. They are timid and wary; and their senses are very acute. Hunters find great difficulty in reaching near enough to shoot them. The height of the Moose at the shoulders is about seven feet. Much confusion has existed on account of the name Elk being applied to two of our American species; we, therefore, adopt the more comprehensive title.

RANGIFER.—*Ham. Smith.*

The muzzle in this genus is entirely covered with hair. The hoofs are broad, depressed, and bent in at the tips. The external metatarsal gland is above the middle of the leg. The antlers are present in both sexes.

WOODLAND CARIBOU; REINDEER (*Rangifer caribou*).—This is regarded as a peculiarly American species. It is large, measuring three feet and six inches in height at the shoulder. Professor Baird gives the measurements of an individual two and a half years old as follows: "To root of tail, seventy-two inches; tail vertebræ, four inches; with hairs, six and a half; height of the shoulder, forty-two inches; from nose to ear, fourteen; height of ear behind, five inches." The antlers of the Reindeer vary exceedingly. The relationships of this species to the European Reindeer are not well ascertained. By some zoölogists it is supposed to be the same; by others different. "The opinion is gaining that the barren ground species is distinct, and as this species cuts it off from the Arctic Circle, it would seem most probable that it cannot be the same with the animal inhabiting the circumpolar region of the Old World."—*Baird.* This species is considerably larger than the Barren Ground Reindeer, but has smaller antlers. Richardson considers its northern limit as south of Hudson's Bay, reaching as far west as Lake Superior; southerly it extends to New Brunswick and Maine. In the earlier times it probably ranged over the greater portion of New England. It is not found near the Rocky Mountains. Mr. Emmons, in his *Report on Quadrupeds of Massachusetts*, 1840, says: Whether the Caribou was ever an inhabitant of this State (Mass.) is now diffi-

cult to ascertain. It is only a few years since it occasionally appeared in the northern parts of Vermont and New Hampshire.

BARREN GROUND CARIBOU (*Rangifer grœnlandicus*).—This is much smaller than the preceding. The bucks, when fat, weigh eighty to one hundred and twenty-five pounds. The horns, however, are much larger, and are more graceful in form. It is found in the barren regions of Arctic America. Dr. King, an author on *Mammalia*, asserts that this species is peculiar in the form of the liver, and that it does not have any gall bladder.

Professor Baird says: "It is a question, admitting this to be a distinct species, whether it should bear the name Grœnlandicus or Arcticus. Following the strict law of priority, however, I have retained the former, although objectionable on account of its local character."

CERVUS.

This genus, according to Wallace, includes forty species. It embraces those forms called true Deer. They are mostly confined to the northern hemisphere. Nine species are found in South America, and about the same number in North America, according to Andrew Murray. None are found in Australia, nor in Africa proper; that is, south of Sahara. The characters of Cervus are seen in the large horns, which curve backwards; the snags being directed forwards. The tail is very short; the hoofs broad and rounded. The species are all rather large.

WAPITI (*Cervus canadensis*).—Plate III, fig. ix.—So large and distinguished is this American Deer, it remains a matter of regret that its characteristics should not be better known. Very many are uncertain what animal is indicated when Elk is mentioned, or the Moose, or the Stag, and American Stag. Wapiti is more distinctive. Yet it is not extensively known. Some European authors, while describing Elk, add, as a synonym, Moose. This is one source of perplexity with our "general reader." In the late issue of *Johnson's Cyclopœdia*, New York, the subject Elk stands for Alces malchis (Moose), and the author adds: "The true American Elk (*Alces americanus*) so closely resembles the above species that some writers regard them as identical." Now, one reading the article, from which the above extract is taken, would readily become more confused, as the last two species referred to are really varieties only of the Moose, which is so familiar to people of Maine and Canada; Alces malchis being the variety common to the northern and corresponding parts of Europe and Asia. The above-quoted article continues, however: "The beast generally known in America as the Elk is the Wapiti (*Cervus canadensis*), an animal nearly as large as the Moose. Several other large species of Deer are known locally as Elks, as in Ceylon; or of Antelope, as in South Africa. The true Elk, then, is what is called, in our North-eastern States and in Canada, Moose." Dr. Gill says of the Wapiti, the subject of our present writing: "It is more generally called Elk, but very improperly, inasmuch as the name belongs by right to the Alces malchis, otherwise called the Moose." If one example is of service in the way of correcting the confusion of nomenclature, we gladly embrace the opportunity, and place at the head of our article the title which is determined to be the only safe one, and that is, WAPITI. Dr. De Kay records as local names the following: Red Deer, Stag, Gray Moose, La Biche, Gray Elk, and Round-horned Elk; and he adds: "It is surprising that for so long, and in some districts so common an animal, so little is known of its habits. It is still (1842) found in the State of New York, but very sparingly. * * * They are found in the north-western counties of Pennsylvania, and the adjoining counties of New York." The Wapiti is closely allied to the Red Deer or Stag of Europe. It is larger, and more imposing even than the latter, notwithstanding some authors affect to regard it as "stupid and Donkey-like in habits." There seems to be a great difference of opinion concerning its nature. Those who have been familiar with the animal in its wild state, as well as when confined, agree that it shows a bold and noble front, and exercises as much spirit as any. It is next in size to the Moose, measuring over five feet at the shoulders, and seven feet nine inches from the nose to root of tail. The latter organ, however, is so short that it is hardly more than rudimentary. It lives in herds of considerable magnitude, even numbering several hundreds, which are usually under care of an old buck, who appears to exercise a strict discipline over them. Like others, it is fond of swimming, and readily takes to the water when pursued. Great difference of opinion is expressed concerning the value of its flesh; some state that the hunters prize it, and particularly the marrow of its bones. The skin and horns are certainly of great value to the native tribes. The latter are sometimes nearly six feet in extent, from tip to tip. The color of the pelage is a light chestnut-red, with an abrupt patch of yellowish-white covering the rump and upper portions of the thighs. In winter the color is more gray. The Wapiti was once the most widely distributed of any American Deer, its range extending from ocean to ocean, and reaching as far north as latitude 57°. At the present day it is not seen often eastward of Pennsylvania and Virginia. Audubon says: "When we first settled in Kentucky some of them were still to be met with, but at present (1847) none are to be found; and they are not really in numbers until you pass the upper waters of the Missouri. They do not confine themselves to water-courses, but roam over the prairies." Audubon refutes, with indignation, the statements which tend to "corrupt the reputation of this noble animal. He is always found to be wary and cunning as any of the Deer kind."

AMERICAN RED DEER (*Cervus virginianus*)—Plate III, fig. x.—There is quite as much confusion here regarding the nomenclature, or trivial names. To call the creature the Virginia Deer is to name with no special signification, as it is not particularly of that region. The term Red Deer is very well known to readers as another name for the Euro-

pean Stag; and a small species, herein described, is called the South American Red Deer (*Coassus rufus*). The term Carcajou is sometimes used; and DeKay calls it the American Deer. The latter is quite unwisely selected, as several other species are so closely connected with it, and found in nearly similar localities, that great confusion is the result among those not familiar with the nature of them.

WHITE-TAILED DEER (*Cervus leucurus*). -This is C. macrourus of Rafinesque, and the LONG-TAILED DEER of Lewis and Clark. Its specific characters are seen in the rather long tail, long and narrow hoofs, and compact fur. The skin is entirely white, with a small dusky spot on the lip. The ears are gray, with a white spot at the base. The anal region, and the under surface of the tail, white. The tail is reddish above. "The ear is narrow, but long, measuring 6.20 along its anterior edge; its greatest width 4.50. They are thinner and more acuminate than in the Virginia Deer."—*Baird.* The feet are long and slender. The prevailing color in the fall of the year, and probably in the winter, is a yellowish-gray, clouded and waved with black, caused by the dusky tips to the hairs. This is purest and grayest on the back, neck and head, the long hairs on the head only being more fulvous. The chin and throat are dull white; the former without any band, but merely a dusky spot on the side. The ears are uniformly brownish-gray, lined and pointed somewhat with dusky, the concavity and basal portion being white. The horns resemble very closely those of the C. virginianus, from the eastern portion of the United States. The horns are more inclined to have three posterior snags than the latter. In extreme age the horns become more compressed, and the warts towards the base more prominent. This species is very abundant on the Upper Missouri and Upper Platte, where it replaces the Virginia Deer.

SONORA DEER (*Cervus mexicanus*).—This Deer is described by Prof. Baird as "resembling the C. virginianus in horns and general characters, but smaller; color varying but little with season; ashy or grayish-brown, pointed with light gray annulations to the hairs. Tail but little longer than the ears, white beneath and on the sides; whitish, with yellowish-rufous tinge above, except near base, where it is like the back. Gland on the hind-leg as long as the bone is thick." The tail measures seven inches to the tips of the hairs, and about five to the end of the bone. The hoofs are rather short and broad. The horns are regarded as like those of the virginianus, "but, perhaps, with finer points." Prof. Baird says: "There is some doubt as to whether it is the true C. mexicanus of authors; I shall, however, apply the name provisionally."

The principal difference is seen in its smaller size. It is grayer in color, the hoofs are shorter and broader, the tail shorter and whiter, and the ears are thinner.

MULE-DEER (*Cervus macrotis*).—This is quite readily distinguished from other species by its long ears, and its larger size. It is next to the Wapiti in general dimensions. "The horns are doubly dichotomous, the forks nearly equal. The ears are nearly as long as the tail. In winter the pelage is ashy-brown, with light gray tips and annulations. The tail is cylindrical, very slender, naked beneath, except at the end, which is a black tuft. The hair is very coarse and brittle, resembling that of the Antelope. The winter coat is very dense and shaggy." The range of the Mule-deer is mainly in the Upper Missouri region, the Yellowstone River being its more favored locality.

BLACK-TAILED DEER (*Cervus columbianus*).—This Deer is regarded as strongly marked, and readily distinguished from C. virginianus. Its specific characters are: "Size about that of C. virginianus, or less; horns doubly dichotomous, the forks nearly equal; ears more than half the length of the tail; gland of the hind-leg about one-sixth of the distance between the articulating surfaces of the bone; tail cylindrical, hairy and white beneath, almost entirely black above, the under portion of the tip not black. Winter coat with distinct yellowish-chestnut annulation on the dark ground, without white patch on the buttocks. There is a distinct dusky Horse-shoe mark on the forehead anterior to the eyes." This is more closely allied to C. macrotis; the long ears and bifurcations of horns being similar in each. Its habitat extends through Oregon to California. Lewis and Clark named it the BLACK-TAILED FALLOW DEER.

SOUTH AMERICAN CERVIDÆ.

Andrew Murray, in *Distribution of Mammals*, records the genus Elaphus, with species antesiensis, from Peru; E. auritus, inhabiting Brazil; E. campestris, Brazil and the Rio Negro of Patagonia; E. chiliensis, from the Cordilleras of Chili. E. casiacus is a Mexican species. E. goudoti is from New Granada. E. gymnotis is from Cayenne and Bogota; E. leucotis from Patagonia; E. paludosus from Brazil to Patagonia; E. punctulatus, Brazil; E. savannasum, British Guiana; E. superciliaris, Brazil. These are all of the genus Cervus, sub-genus Elaphus, according to Murray. The sub-genus Subulo embraces the species nemoziragus, which is found in the plains and mountains of Brazil, Peru and Paraguay. S. pudu is another, found in the Cordilleras of Chili. Another form, quite rare, is that of

THE RED DEER OF SOUTH AMERICA (*Cervus (Subulo) rufus*)—Plate III, fig. xii.—This is one of the small species but little known out of its native country, the middle regions of South America. Two specimens, male and female, are in the cabinets of the American Museum, New York.

CAMELOPARDALIDÆ.—This is exclusively an Old World family, having one genus and one species, confined to Africa. No extinct species has been found in America.

FAMILY—BOVIDÆ.

The familiar term, Bos, is pretty universally applied to individuals of this group of animals—the Oxen, Cows, Bison, Buffaloes, and the like. All are

very naturally recognized as of the same relationship, and are quite readily named as above, *Bos* being the Latin noun for Oxen-like creatures. This group is characterized by the hollow horns, broad muzzles, powerful limbs, and a general massiveness of body. By Wallace's exhibit of the family *Bovidæ*, in which he includes, besides the above named, Antelopes, Sheep and Goats, there are thirty-four genera and one hundred and forty-nine species. Among sub-families which he constructs out of this number, that of *Bovinæ* has six genera and thirteen species. This sub-family embraces the same forms seen in our present family.

BISON.

This genus is quite restricted, not only in the number of species but in individuals, particularly as regards the European species, which has gradually succumbed to the advance of civilization. The American form is also rapidly passing away.

The Bisons are characterized mostly by their short horns, which curve inwards at the point, and by an extra pair of ribs; the usual or normal number in Bos being thirteen. The hair is long and shaggy, and in the males is developed into a very prominent mane on the neck, shoulders and head.

AMERICAN BISON (*Bison americanus*)—Plate 18, fig. 59.—This is a familiar animal to most people of the United States, and an important one to the unsettled population of the large western portions. It is asserted on all hands that the BUFFALO, as it is almost universally termed, is rapidly on the decrease. The wholesale destruction of the beast is much deplored, as a large portion of the creatures slain are not utilized sufficiently to warrant it.

A fine specimen of male Bison has been kept at Central Park, N. Y., many years; a female was at one time kept with it, and a male Calf was raised from them. This individual, the Bull, presents a noble exhibit of the peculiar features of the species. The strength which he exerts, in his wild tossings and buttings against the heavy iron cage, is something marvelous to behold; the heavy iron bars are bent and forced from their beds, and great caution is requisite to keep the creature within proper bounds.

The uses of this animal are too well known to dwell considerably upon them. The flesh is a great boon to the savage tribes, eaten fresh, or in a dried state for winter use; the skin is largely used, both by the natives for tent covers, and the endless purposes of nomadic life, and by peoples of cold climates as robes and clothing.

The term Bison was anciently applied by Pliny to the Wild Ox of Europe. The genus Bos, as at present determined, is represented by "only one living species" (Wallace), and this the descendant of the ancient B. primigenius, which ranged over Central Europe in the time of the Roman Empire. The Chillingham wild cattle are regarded as the nearest living allies of the ancient Bos. The Buffaloes, Yaks, and other forms in Africa and India, are now arranged under other generic names, as Pœphagus, Bubalus, Bibos, Anoa, etc.

Audubon says: "In the days of our boyhood and youth, Bison roamed over the small and beautiful prairies of Indiana and Illinois; herds of them stalked through the open woods of Kentucky and Tennessee; but they had dwindled down to a few stragglers, which resorted to the 'barrens,' towards the years 1808–9, and soon after entirely disappeared. Their range has since that period gradually tended westward." Audubon exclaims, in his enthusiasm, at the novel sight before him, when viewing the vast herds of these animals seen in the Missouri region. The herds wander great distances, and many are killed by falling into the deep ravines, which they are forced to approach by the vast multitudes always pressing on in their migrations. During Mr. Audubon's last journey on the plains, Mr. Bell, the taxidermist of New York, accompanied him, from whom we have often heard most spirited relations of the chase, and incidents of Bison migration. They "passed through herds six days in succession." At another time they "saw the prairie black with them, covering the view as far as the eye could reach." Though huge and heavy, they are represented as exceedingly frolicsome, gamboling as we often see domestic cattle do. Mr. Audubon relates that a gentleman in Kentucky, Mr. Robert Wickliffe, kept a herd of Bisons over thirty years. "They were as docile as other cattle, grazing with his domestic herd in the same field. The tame Bull was unwilling to breed with the Bison-cow, but the Bison-bull produced a cross with the common Cow. From the latter I have several half-breeds, one of which is a heifer; this I got by a domestic Bull to produce a Bull-calf, which proved to be a very fine animal, of large size." These crossed or half-breeds are larger than either the Bison or common Cow.

Audubon states that the Bison was formerly common in North and South Carolina.

THE EUROPEAN BISON (*B. bonassus*) is one of two species that now inhabit the globe, and this is well-nigh extinct, or probably would be were it not for the protection given it by the Czar of Russia, who has for many years preserved them on the confines of Lithuania. This species is considered to be identical with the great fossil Auroch of the European cave deposits—the Bison priscus of Owen. The term *bonassus* was applied to it by the ancients. It is very rare in collections, particularly in America; a good specimen of the stuffed skin of an Auroch is in the American Museum, in Central Park, New York. This creature, though having the general aspect of the American Bison, stands much higher, its legs being longer, and its body is larger and more elongated; the shoulders are not so strongly produced, and there is much less of the shagginess of that region. We give place to this species, though foreign to our shores, as it is of great interest, being the only other form of this genus. The Buffaloes are more numerous, but there are only two species of Bison.

SUB-FAMILY—ANTILOCAPRINÆ.

ANTILOCAPRA.

In the family *Bovidæ* Wallace places, with others, this single genus with its single species, as forming a sub-family. This form is regarded as very peculiar on account of the "great compression of the basal portion of the horn, with the prominent angular flattened process on its anterior edge." The absence of the small false hoofs is another remarkable feature. Prince Maximilian asserts that traces of one of those false hoofs may sometimes be seen in the fore-feet, but never two together. This genus was described by Hamilton Smith as Dicranoceros.

PRONG-HORN ANTELOPE (*Antilocapra americana*).—This is the well-known Antelope of our western plains; called, also, PRONG-BUCK (Fig. 61, p. 172, vol. 1), Berendo of the Mexicans, and Cabru and Cabrit. It is regarded as nearer the European Chamois than any other form. Its range is rather limited, being confined to the temperate regions of North America, and to the more western portions comprised within the limits of the Mississippi River and the Pacific Ocean. It does not pass east of that river, and only reaches it in high latitudes. It is now found only west of the Missouri River. It was very abundant in California about the time of its settlement. Its favorite range is upon the barren or naked plains, avoiding quite sedulously the timber lands, as it depends on its fleetness for escape from enemies. Lewis and Clark first noticed this animal, describing it in a report of their expedition up the Missouri River country. The Prong-buck is not so large as the Virginia Deer. An average adult, from the nose to the end of the tail, measures from four feet ten inches to five feet. The height at the shoulders is two feet and ten inches; at the hip, three feet and one inch. The eye is larger than that of any known quadruped of its size, being nearly that of the Elephant. It is intensely black in color, but soft and gentle in expression, rivaling the true Gazelle in its winning aspect.

Long before the truth was known to science, hunters had observed that the horns of the Prong-horn Antelope were "dropped" as are those of the Deer; yet no definite information was elicited or recorded. In 1848 Dr. Canfield, of California, sent the information to the Smithsonian Institution, but the circumstance was so contrary to known examples that no special interest was awakened. In 1855 Mr. Bartlett attested the fact in the Zoölogical Gardens of London, and in the February following Canfield's paper was published. "The creature has a deciduous, hollow horn, which envelops a persistent core, which is a process of the skull. This shell is true horn, and has the same general system of growth as other horns, although it is cast annually like antlers of Deer. It thus reveals an intermediate link between the two principal groups of hollow and solid-horned ruminants." The lower portion only is hollow; this is quite flat, but the point or other half is round, and becomes polished by wear. A striking characteristic in this creature is seen in the presence of numerous cutaneous glands—eleven in number—which secrete a strong, pungent odor ("a strong, *hercin* odor," says Richardson). Those below the ears more particularly are potent; as also those of the ischiatic region. Dr. Murie regards the Prong-horn as a "Giraffe-hoofed, Sheep haired, Deer-headed, Goat-glanded Antelope." The flesh is much prized, having the reputation of being superior to either beef or venison. It is "dark, fine-grained and tender, with an agreeable flavor." This creature is a strictly herbivorous feeder. It is timid and shy. In fleetness it is said to excel all other quadrupeds upon the plains, but does not long maintain its speed. It is particularly gregarious; and Canfield credits it with being astonishingly salacious—exceeding the Goat in this propensity. The curious white patch on the stern, which is so conspicuous, and elicits a query as to its use, being so abrupt in its color and form, is said to exhibit an erect and radiated aspect when the creature is at play or excited. The same is seen on the stern of the Wapiti, and is, no doubt, similar in functions. The Prong-horn is readily tamed, and soon loses its shy, timid action. Its true place in the animal kingdom is thought to be nearer the Antelopes than any other group. In leaping it makes enormous horizontal distances, but fails in a vertical direction. Like the Deer it has four active mammæ, while the Goat has only two. In common with the hollow-horn ruminants it has a gall bladder, which is wanting in all *Cervidæ*.

The female is sometimes found seemingly with no horns; they are, however, present, though concealed by the fur, being mere rudiments or knobs. The hair is curiously tubular, and is stiff and harsh.

SUB-FAMILY—NEMORHEDINÆ.

In this sub-family Wallace includes two genera and ten species. These are the Goat-like Antelopes. The typical genus—Nemorhedus—has nine species in Asia. The one other genus—Aplocerus—is wholly American, and is represented by only one species—the Rocky Mountain Goat.

APLOCERUS—*Ham. Smith.*

This genus has variously been designated, as Haplocerus, by Wagner; and Mazama, by Rafinesque and Gray; Capra, Antelope and Ovis. This form is a true Antelope in all essential features and affinities, though having somewhat the aspect of the Goat, from whence it derives its trivial name. In this genus the horns are very small, and ringed at the base. The nose is hairy, and ovine in aspect. It has no muffle, and no tear bag. There is under fur, short and woolly; and the outer fur is long and pendant. False hoofs are present.

THE MOUNTAIN GOAT (*Aplocerus montanus*).—Plate III, fig. xi.—This is extremely unfamiliar, and is the only animal of the kind known. It is exclusively American. Probably the creature is not rare among the far-off and snow-clad peaks of the Rocky Mountains, yet it is so nearly inaccessible in its

favorite habitat that the most experienced trapper, hunter or native has but a trifling stock of information concerning it. A few specimens have been brought to the east through the agency of the officers of the Great Western and Pacific Railroads. The long and rugged path along which the hunter has to drag his game has so far proved an effectual barrier to his preserving, in suitable condition, any considerable number of these animals. Skins and portions of the carcass are not unfrequently brought in; but the whole animal, or its perfect skin, is a rare and valuable thing.

The Mountain Goat is entirely white. The horns, hoofs and the edge of the nostrils are black. Like the Goats it has a tuft of hair under the chin. It is closely allied to the Chamois of the Alps. The most northern range it attains is latitude 65° north.

SUB-FAMILY—CAPRINÆ.

The Goats, Sheep and Musk-ox are embraced in this group. Two genera and twenty-three species are enumerated. Capra is represented by twenty-two species, and Ovibos by one. Of the number in genus Capra one only is indigenous to America. Ovibos was formerly common to the Arctic regions of both continents, but is now confined to the American.

CAPRA.

Late writers place the Big-horn or Mountain Sheep in this genus. Wallace drops the genus Ovis, and places the genera Capra and Ovibos as sole representatives of the sub-family *Caprinæ*.

MOUNTAIN SHEEP; BIG-HORN (*Capra montana*)—Plate 18, fig. 61.—This noble-looking animal enjoys a similar notoriety to the preceding. As it is the only one of its kind it is unique. It is not so difficult to procure, and, consequently, we see it oftener in collections. A full-grown adult male is a marvel of power in its head and horns. The latter are enormously developed. The female has smaller horns, and is less in size. This species is much larger than the domestic Sheep. Audubon says: "A large Big-horn will weigh three hundred and fifty pounds, perhaps more; it is larger than a Virginia Deer." A magnificent pair—male and female—prepared by Professor Ward, are in the American Museum. Professor Baird gives some statistics of weight, etc., of the horns, as follows: "In one old animal, the horns are nineteen inches apart at the tip; they measure fifteen and a half inches in circumference at the base, and twenty-eight inches in length around the curve. They weigh eighteen and a half pounds, with the perfectly clean skull, lacking the end of the nose and the lower jaw. In a specimen brought by Capt. Stansbury, the horns are eighteen inches in circumference; the horn along the convexity thirty-six and a half inches, and the tips eighteen inches apart." A full-grown Big-horn measures about three feet six inches in height at the shoulders.

OVIBOS—*Blainville.*

This genus is characterized by having broad hoofs, inflexed at their tips; a short tail, muzzle not naked, but having a small space between the nostrils devoid of hair, not furrowed; horns much approximated at the base, and very broad, bending rapidly downwards; hair very long and pendant.

THE MUSK-OX (*Ovibos moschatus*)—Fig. 57, vol. 1, p. 163.—This is a very rare animal in collections, none of our native mammals being so unfamiliar. Only one living species is known. It bears a close resemblance to the Sheep, and is considered to be allied to them; the term MUSK-SHEEP is, therefore, more appropriate. It gets its specific name from a certain odor which is exhaled from it; this is said even to impregnate the flesh. It is confined to the barren grounds of Arctic America—beyond 60°—extending northward as far as land is known. Though apparently clumsy, the Musk-ox runs nimbly, and climbs the rocky hills with ease. The Bulls are said to be quite formidable antagonists when closely pressed. Several fossil species are found in this and the Old World. In Europe, remains of this animal are found in cave deposits as far south as the Mediterranean.

ELEPHANTIDÆ.—The Elephants are represented by one genus and two very marked species, the Asiatic and the African. Fourteen species of Elephants, and a greater number of the allied genus Mastodon have been found, fossil and extinct, in the two continents.

HYRACOIDEA.—This is an order which includes only ten or twelve small creatures in one genus, all of the Old World. They are the Conies of Scripture.

The orders *Solidungula* and *Pachydermata* are lost in our arrangement of the species in Wallace's system. Late classification ignores these orders, and with greater propriety adopts the more comprehensive term *Ungulata*. The Horses, therefore, are placed at the commencement of the Ungulates, in accordance with this later system. It is of less importance to us, perhaps, in making this change, as neither of the orders concern us especially, there being no representatives in America. The Horses, indeed, are interesting to us as fossil extinct species, an abundance of material being known to our Western Territories, as we have seen in the chapter on the Palæontology of Ungulates.

ORDER XII.—CETACEA.

THIS order embraces a very interesting and wondrous group of animals—the Whales, from the Anglo-Saxon *hwal*. That they are confined to the waters, and are formed like the finny denizens of the deep, they are quite naturally regarded as fishes by the casual observer. Little anatomical knowledge is required to understand their true position; indeed, one physiological fact, which is most easily determined by any one who witnesses the living Cetacean, settles the matter without qualification: they breathe the external air through lungs, and not by aid of gills whose membraneous expansions, filled with blood, are exposed to the water, from whence comes the life-giving oxygen. Again, the Whales suckle their young, and, consequently, are of the great *Class Mammalia*, which is founded upon that function. Whales are grouped according to certain characters seen in their development. The most prominent are the Whalebone Whales, the *Balænidæ*, so called on account of the mouth having jaws armed with plates of whalebone, the uses of which will be seen further on. The Cachalots, or Sperm Whales, form one group, and the Dolphins another. Whales descend into the great depths of ocean so considerably that we naturally look for some economy of their structure which shall resist the enormous pressure that they sustain. We know that this is so great as to force water through the pores of the hardest woods, and, consequently, to render it heavy like lead. The integuments, though soft and velvet-like, are yet so organized as to resist effectually this pressure. The outside skin is lubricated with an oily substance which prevents maceration of the tissues; then beneath this is the *rete mucosum*, a membrane which holds the coloring matter of the skin the same as that of the Negro; thirdly, the true skin, and the blubber of fat immediately under it. Prof. Jacob, of Dublin, regards the blubber and true skin as one integument, the skin being modified to hold the oily matter in cells. The uses of this blubber will readily occur when we reflect that these creatures inhabit the coldest regions, the deep seas of perpetual ice. The fat suffices to render them warmth, lying, as it does, like a blanket spread over the body. An amount of this blubber on some Whales is estimated at thirty tons weight. This fat is specifically lighter than the waters, and thus renders the creature buoyant and active. The flesh of Whales is much like that of the larger land animals; the bones, too, are solid, and, though less compact, are like those of other mammals. The mammæ are situated on the breast in the group called herbivorous Whales, and are situated on the abdomen in the others. Their milk is said to be very rich, having the taste of Cow's milk to which cream is added.

There is nothing very peculiar in the internal organization of Whales, as compared with other mammals. The physiological fact that they remain a great length of time beneath the water without breathing is remarkable. Man, in a healthy state, must breathe every three seconds. Instances are known, however, of persons remaining three minutes immersed, all respiration being suspended. This is accomplished by a girl who is on exhibition throughout the country. The economy of the circulating system in the Cetaceans is seen to differ from that of land animals, inasmuch as we find a development of the arterial canals which serves as a reservoir for arterial blood—that rich, red blood which is required as the life-giving pabulum. A large portion of the interior of the chest is lined with this plexus of blood-vessels, and the various interstices between the ribs, and a large cushion is formed by it exterior to the ribs and along the spine; it is even distributed within the spinal column, and even on the interior of the cranium. The amount of blood in a Whale is, comparatively, very large, a circumstance which this reservoir at once explains. It is understood that the blood is at a higher temperature than in terrestrial animals, ranging as high as 104°. The nostrils, through which they take all the air required, are situated on the top of the snout, or in some appearing to be directly on the summit of the head. The nostrils, or "blow-holes," communicate, as in all other mammals, directly with the passages to the lungs; a peculiar mechanism of the throat, which is supplied with valves, prevents the water that may be taken into the mouth from passing into them. Regarding the voice of Whales, there seems to be little to communicate. Mr. Scoresby, an experienced scientific Arctic observer, says: "Whales have no voice"; and it is generally understood that all others are similarly deficient. Older authors, and some observers of the present day, affirm that they have heard them bellow and utter loud cries. Cuvier did not doubt these statements, but acquiesced in them. One species, the Melas, has obtained its trivial name from the alleged circumstance that it "calls"; hence the "Ca'ing Whale." It is most reasonable to admit these as facts, as the other Marine Mammals have voices of the most potent character.

The brain of the Whales is small comparatively. One of a specimen nineteen feet long, and weighing 11,200 pounds, weighed only three pounds twelve ounces; that is, "one-three-thousandth part of the whole animal." In man it is calculated to be "one-thirty-fifth part." The Porpoises and Dolphins seem to have a much larger brain. Cuvier records, "from five examinations, on an average, the brain weighed one-sixty-third part of the whole."

The senses of Whales are considerably beyond our comprehension. With regard to smell, the early

writers concurred in attributing a good degree of this sense; and Anderson, in his account of Iceland and Greenland, narrates that the inhabitants of the Faroe Islands, when they perceived their boats chased by the Sperm Whale, which is regarded as a particularly dangerous species, used to throw Castor overboard, which made the creature sink to the deep, in order to avoid the disagreeable odor. Ginger has a similar reputation; the blood of animals, and Chalk and Sulphur, are supposed to possess even greater powers. Cuvier, as well as some other authors, throws doubt upon this matter by stating that, "in the *Cetacea* there is an absence of olfactory nerves and the usual organs of smell." From a good deal of investigation in this direction, there seems to be certain well-defined facts. The prevailing opinion now is that the sense of smell is possessed by the true Whales and the Rorqual, and is wanting in the rest. This may be subject to certain qualifications when other observations are made. The organ of vision is very small, compared to the size of the creature. The largest Whale has an eye not larger than that of an Ox. The range of vision is extensive, the organ being placed on the parts most prominent where the diameter is greatest. Its axis is directed downwards obliquely, and thus aids it in scanning the region below it. The hearing organ is peculiar in some respects: the eustachian tube reaches high up in the blowing-hole, and, as there is no external ear, it is thought that the sounds are conveyed to the auditory apparatus through this passage. Other senses, as taste and touch, seem to be of little consequence, as they are, seemingly, not developed. The mental faculties of the Whale vary in different genera very greatly; they all, however, agree in a certain reciprocal regard that they seem to manifest towards each other. This is common not only between the mother and young, but with members of the same group or shoal. All Cetaceans produce their young in nearly the same manner that land mammals do. The male is called the Bull; the female, the Cow. The period of gestation is supposed to be about nine months. The natural life of Cetaceans is thought to extend to from thirty to an hundred years. The Calf follows the mother several months.

The amount of oil yielded by the larger kind of Whales reaches nearly twenty tuns. The peculiar products of these animals will be noticed under the respective heads. Ambergris is a substance common to all. It is found in the intestines, and is a concretionary formation, mottled and grayish in color, and when exposed on its inner surface, is seen to enclose the horny, beak-like processes of Cuttle-fishes, derived from the great numbers of such mollusks that they eat. It has a peculiar odor, and is used in giving to wines an agreeable flavor. In consistence it is soft and waxy, its chemical constituents being largely the fatty substance or principle called ambreine.

The size of Whales is a subject which has at times been considerably misapprehended. Captain Scoresby, the notable whaler, and afterwards the eminent writer and clergyman of Exeter, Eng., says: "Of three hundred and twenty-two individuals, in the capture of which I had personally been concerned, no one, I believe, ever exceeded sixty feet in length, and the largest I ever measured was fifty-eight, this being the largest I ever saw." An uncommonly large specimen is recorded by the same author, which had the baleen, or whalebone plates, "nearly fifteen feet long." This animal was not over seventy feet long. Captain S. says, again: "The largest common Greenland Whale I ever heard of was mentioned by Sir Charles Gnisecké, who informs us that, in the spring of 1813, one was killed at Godhown, measuring sixty-seven feet. But these are rare instances. I therefore consider that sixty feet may be considered as the average dimensions, and that sixty-five feet is a magnitude which rarely occurs."

FAMILY—BALÆNIDÆ.

The true Whales are classed under this family designation. The great characteristic of this group is the presence of a series of whalebone plates, usually called baleen; hence the term of the family, which is from the Greek, meaning simply a Whale. Curiously enough, the young of these Whales have teeth, which are soon shed, and give place to the sheets of whalebone. The true Whales are recognized, also, from their extremely large heads which, in some species, amount to one-third of the whole length. The nostrils are distinct, and situated longitudinally along the top of the cranium. The mammary glands are in the inquinal region, not in the chest. The hands have five fingers, and are very broad.

THE GREENLAND WHALE, OR MYSTICETE (*Balæna mysticetus*), called also the COMMON WHALEBONE WHALE—Plate 28, fig. 89—is the most familiar Cetacean of our waters. The term Right Whale is used by sailors, to designate it from others that are of less account in commerce; and Bow-head, or Great Polar Whale, are terms also used by whalers. Marvelous stories are told about its length; but Scoresby has fully established the fact that it never exceeds sixty-five or seventy feet.

The characteristic feature of this Whale is the baleen, or whalebone—a series of plates, upwards of three hundred in number, on each side of the jaw, which resemble a frame of saws in a saw-mill. These plates reach the length of six feet, and weigh together, in some instances, a tun. The flesh of the Right Whale is of a red color, and, when cleared of fat and broiled, is said to be much like coarse beef. The bones are very porous, and contain much fine oil. The jaw-bones, which often measure twenty-five feet in length, produce a valuable portion of oil. The hearing in this Whale is thought to be acute while in the water, but is evidently wanting to a great extent while in the air. Scoresby says, speaking of the velocity of this creature: "It is the same along the surface and in other directions. I have observed a Whale descending, after I had harpooned it, to the depth of about one-fourth of a mile, with the aver-

age velocity of seven or eight miles an hour. The usual rate, however, at which it swims, when on passage from one situation to another, seldom exceeds four miles an hour. They are capable, however, of darting through the water with the velocity of the fastest ship under sail, and of ascending with such rapidity as to leap out of water." This species usually remains on the surface to breathe about two minutes, seldom longer. During this time it blows eight or nine times, and then descends for an interval usually of five or ten minutes, and sometimes, when feeding, fifteen or twenty minutes. This is the opinion of shrewd observers; and Scoresby adds: "The Right Whales have no voice, but, in blowing, make a loud noise. The vapor they eject rises several yards, and appears at a distance like a puff of smoke." The depth which they attain, when struck with the harpoon, is said to be fully a mile at times; and some observers record broken jaws and crowns, which accidents are attributed to the force with which they dive, even striking the rocky bottom. Whales are said to sleep in calm weather. Such an occurrence was observed among the ice-floes of Baffin's Bay. The food of these Whales is most remarkable, considering their wonderful bulk. They have no teeth, and their throat is extremely small; consequently they cannot prey on the larger marine animals. They feed in certain regions called by sailors "Green Water." Captain Scoresby examined this water. He says: "It forms, perhaps, one-fourth of the Greenland Sea, between the parallels of 74° and 80°. Though liable to shift by the currents, yet it is always found near certain situations. It is an olive-green, and of decided opacity." Captain Scoresby found that this color of the water was due to innumerable animalcules, most of them microscopic; the greater number being *Medusæ*. These constitute the food of this enormous creature, the Great Greenland Whale. With mouth wide open, it swoops through this sea of living forms, and fills its enormous mouth; then, by an expulsive movement, the water is strained through the whalebone sieves and rejected, the jelly-fish food passing through the small swallow passage to the stomach. The period of gestation is thought to be about nine months, and one only is produced at a birth. At the time of birth, the young is ten to fourteen feet in length. The cub is supposed to accompany the parent about a year, as the balæn does not reach a sufficient size to enable it to provide its own food before that time. It appears to attain its full growth at the age of twenty or twenty-five years; its full age is thought to be very great. The attachment of the parent for its cub is very marked and interesting; the whalers often take advantage of this fact to capture the dam. Captain Scoresby speaks with much feeling of the affection displayed, and the anxiety of the dam when the young is in danger of capture. The great creature becomes insensible of danger, and sacrifices everything to secure its young. This species, though sometimes found in company, yet is generally found solitary, or in pairs. The products of this Whale are all important to the inhabitants of the Arctic regions.

Captain Scammon, in his great work on the *Marine Mammals of the North-west Coast of America*, relates that this Whale has been observed to remain on the bottom an hour and twenty minutes after being struck, and then to come to the surface completely covered with mud. The Arctic Bow-head, according to Captain Scammon, is comparatively free from parasitic animals. A species of Cyamus is seen, in some cases, about the fins or head. The range of this Whale is from east to west, from Nova Zembla to the coast of Eastern Liberia.

Dr. Gray, in his *Supplement to Catalogue of Seals and Whales*, records, as ranking next to the present species, the following, which inhabits the Mediterranean Sea:

THE MEDITERRANEAN WHALE (*Balæna Mediterranea*).

Balæna angulata is next given, with its habitat as the North Sea.

Balæna nordcaper is another, named by Bonnat, which is synonymous with B. islandica of Brisson and B. biscayensis of Eschricht. This may be called

THE NORDCAPER (*Balæna nordcaper, Bonnat*).—This species is reputed as much more active than the Greenland Whale, much quicker in its movements, and consequently more difficult to capture. It is smaller, and has less blubber than the last-mentioned. Its head is shorter, also, and it has less of the whalebone. It is infested with a parasitic Cirriped, which attach themselves in great numbers around the head and fins. It is regarded as a regular inhabitant of the temperate portions of the North Atlantic.

NEOBALÆNA.

In this genus the skull is somewhat depressed, with brain cavity nearly as long as the beak, depressed, and much expanded on the sides, with a very deep notch on the middle of each side, over the condyles of the lower jaw, and with a sub-triangular crown-plate. The nose is as broad as the expanded brain cavity at the base, regularly attenuated to a fine point in front, and slightly arched downwards. The lower jaw is luminar, compressed and high; the upper edge is thin, and inflexed the greater part of its length, and is erect in front; the lower edge is inflexed in front, the rest of the edge being simple. The baleen is elongate and slender, several times as long as broad, with a fringe of a single series of fine fibres; the enameled surface is smooth and thick.

ANTARCTIC RIGHT WHALE (*Neobalæna Marginata, Gray*).—This is regarded by whalers as the representative of the Right Whale in the Antarctic seas. It is not over sixteen feet in length, but has the reputation of furnishing the "most beautiful, the most elastic, most flexible, and the toughest whalebone or baleen yet discovered."

EUBALÆNA.—*Gray.*

This genus is placed by Gray in a group that has thick baleen, with no polish, but with a thick, coarse

fringe, and a thin enamel coat on each side. The generic characters are seen in the breadth of the first rib at the vertebral end—the square tympanic bone, the aperture of which is nearly as long as the bone. The first six cervical vertebræ are all united by their bodies. The upper lateral process of the atlas is sub-cylindrical, narrow at the base, recurved and rounded at the end; the lower lateral process is narrow at the base, swollen and rounded at the end. The carpus, or wrist, is cartilaginous, with six carpal bones—a radius and cubitus, one radial and one cubital, and two carpals in the second range. The shoulder-blade is as long as broad, with a small cylindrical coracoid process, rounded at the end. Five phalanges to the middle finger, four to the index and ring fingers, four to the little finger, and two to the thumb. The first rib is simple at the upper and thin at the free edge. The nasal bone is rhomboidal and moderate. The vertebræ number fifty to fifty-nine. —*Gray*.

SEIBOLD'S RIGHT WHALE (*Eubalæna seiboldii, Gray*).—This is figured in Captain Scammon's *Marine Mammals of North-west Coast N. A.* as Balæna seiboldii, and is synonymous with B. japonica of Gray (*Zoölogy of Erebus and Terror*), the same of Eschricht, and B. alutiensis of Meyer. In principal parts this species resembles the Great Greenland Whale. The latter, however, has no appendage called the "bonnet," which is so conspicuous in the present, upon the anterior extremity of the beak-like upper jaw. Another species, the Eubalæna australis, Gray (B. australis of Cuvier and B. capensis of Gray), is particularly a Southern one. It measures only about forty feet, at most. The upper jaw is so considerably curved that the baleen is really much longer than in others. This Whale appears in great numbers off Terra del Fuego and the western coast of South America, and ranges to the coast of New Holland and the Cape of Good Hope. Eubalæna cisarctica is a species named by Prof. Cope, and described by him in the *Proc. Acad. Nat. Sci., Phila.*, 1865. It is identical with B. biscayensis of Van Beneden.

HUNTERIUS.—*Gray*.

The characters of this genus are a broad first rib, with a double head at the vertebral end; tympanic bones square, the apertures of which are nearly as long as the bone. The vertebræ number fifty-seven or fifty-eight, the five first cervical-united. In the fourth, or ring finger, are five phalanges, and in the second, third and fifth are four. The first rib is bifid and articulated to the first two dorsals, or the last cervical and the first dorsal; the second rib very thick at the free end. The nasal bones are very large. Three species are enumerated by Gray. Neither are inhabitants of our seas.

CAPEREA.—*Gray*.

This genus is confined exclusively to the regions about New Zealand. One species only is enumerated.

MACLEAYIUS.—*Gray*.

Of this genus Gray makes one living species and one fossil, from Lyme Regis in England. The former inhabits the Australian seas.

SUB-ORDER—BALÆNOPTEROIDEA.

Animals of this sub-order have the head moderate in size; the body elongate; the dorsal fin distinct, and rarely wanting. The belly is rarely smooth, but usually plaited longitudinally. The baleen is short and broad. The maxillary bones are broad; the pectoral fin is lanceolate, and arms elongate, the radius and ulna much longer than the humerus. The fingers are four in number, sub-equal. The vertebræ of the neck are free, or partially united. The tympanic bones are oblong or ovate.

FAMILY—AGAPHELIDÆ.

SCRAG WHALES.

Family characters are moderate head, elongate body, hinder part of the back keeled or notched; cervical vertebræ free; pectoral fin lanceolate; fingers number four. The throat has no plates; there is no dorsal fin; and the ribs are single-headed.

AGAPHELUS.—*Cope*.

The generic characters are essentially those of the family above named. The acromion is present on the scapula. Prof. Cope, who describes this genus, says: "The baleen is peculiar. Throughout the length of the maxillary bone it nowhere exceeded one foot in length; and the width of the band, or the length of the base of each plate, four inches. It is of a creamy-white; the fringe very coarse, white, and resembling hogs' bristles."

THE SCRAG WHALE (*Agaphelus gibbosus, Cope*).—This is the only species yet described. It inhabits the North Atlantic.

RHACHIANECTES.—*Cope*.

This genus, established by Cope, has the cervical vertebræ free; the throat without plates; has no dorsal fin, and no acromion process to the scapula.

THE CALIFORNIAN GRAY WHALE (*Rhachianectes glaucus, Cope*).—Of this species, Prof. Cope remarks: "The points in which this species differs from those of the genus Balæna, previously known, are numerous, and will no doubt be increased on a further knowledge of the animal. The head, between one-fourth and one-fifth of the total length, allies it to the short-head species. From the B. australis the number of dorsal vertebræ, and the color and shortness of the baleen, distinguish it."

FAMILY—MEGAPTERIDÆ.—*Gray*.

HUMPBACKED WHALES.

The dorsal fin is low and broad; the pectoral fin very long, with four very long fingers, of many phalanges. The vertebræ number fifty or sixty. The

cervical vertebræ are often anchylosed. The neural canal is large, high and triangular. The ribs are fourteen or fifteen.

MEGAPTERA.—*Gray.*

The generic characters are seen in the absence of an acromion and coracoid processes to the scapula, and in the body of cervical vertebræ being subcircular.

LONG-HANDED HUMPBACK (*Megaptera longimana, Gray*).—This was described by Gray, also, as M. boops. It inhabits the North seas. A species inhabiting the seas of New Zealand is named by Gray M. noræ zelandiæ.

BURMEISTER'S HUMPBACK (*Megaptera burmeisteri, Gray*).—This is recorded in Gray's *Catalogue* with a mark, "?" after the generic name, and is given as a synonym of M. lalandii of Van Beneden. Its habitat is Buenos Ayres. A skeleton is in the Museum there.

THE AMERICAN HUMPBACK (*Megaptera americana*).—Gray places this as an inhabitant of Bermuda waters, and adds a note quoted from Hartt's *Geology and Physical Geography of Brazil*, page 182, as follows: "The Norwega is a Humpback, which has the belly white and smooth (?); back, very dark bluish; length, fifty to fifty-five feet. This Whale gives more oil than the Mystica. The whalebone is short, and sells well. The beach on which the Whales are cut up is strewed with bones. The fishery is carried on at Bahia on a much larger scale than at Caravellas."

Megaptera kuzira is another form, having its habitat in Japanese seas, a skull of which is at the Museum in Leyden.

Megaptera osphyia.—Prof. Cope, in *Proc. Acad. Nat. Sci., Phila.*, 1865, describes this species, and gives the Atlantic as its locality. A skeleton of the creature is in the Museum at Niagara. This particular specimen is about thirty-four feet in length; but Prof. Cope is of the opinion that it belongs to one of the largest of the *Balænidæ*. The baleen measures two feet in length, is black, with three rows of coarse bristles. Its base is one curve; its length is spirally twisted.

Megaptera versabilis.—This is another species, described by Prof. Cope, in 1869, in *Proc. Acad. Nat. Sci., Phila.* Its habitat is the North Pacific and the California Coast.

Captain Scammon, in his *Marine Mammals of the North-west Coast of N. A.*, remarks, concerning the multiplication of species—upon paper: "We have frequently recognized, upon the California Coast, every species here described, and even in the same school or 'gam.' Moreover, we have experienced the greatest difficulty in finding any two of these strange animals externally alike, or possessing any marked generic or specific differences. If the differences pointed out as constituting different species are maintained, we conclude there must be a great number. We have observed, both in the dead and living animals, the following different external marks. *First:* Body black above, white beneath. *Second:* Body black above and below, with more or less white mottling under the throat and about the abdomen; pectoral and caudal fins white beneath, or slightly spotted with black. *Third:* Body black above, white beneath, with under side of pectoral and caudal fin of a dark ash color. *Fourth:* Body black above, with gray mottling beneath. In all these varieties, both the caudal and pectoral fins differ in shape and size; the latter, in some individuals, being exceedingly long, narrow and pointed, while others are comparatively short and broad. There are still others whose pectorals are of intermediate proportions, but terminate abruptly, which also represent the scalloped flukes present in some individuals. Again, in other examples, the caudal fin is narrow, pointed and lunate; in others, still, it is broad, and nearly straight on the posterior edge. All these varieties feed and associate together on the same ground, and in every particular their habits are the same, so far as we have been able to ascertain from careful observation. All, likewise, are infested with the same parasites. As to the dorsal protuberance called the hump, it is, as has been previously stated, of no regular shape or size, but is nearly of a uniform height; the posterior edge is sometimes tipped with white. As to the tubercles on the head and lips, they were present on all we have examined—twenty or more specimens. Those about the head are always well developed, while those upon the lips, in many individuals, are scarcely perceptible. In some instances, however, they equal or exceed those which crown the skull. There is no regularity in the number of gular folds, which, as far as observed, vary in number from eighteen to twenty-six. In some cases, they run parallel to each other; but usually there are several that either cross or terminate near the pectorals. The animals are all described as being black above; but, in the examples which have been examined, there was not one, when closely scrutinized, which did not reveal some slight marks of white."

POESCOPIA.—*Gray.*

The forms arranged under this generic heading are characterized as having a shoulder-blade with a small coracoid process, and the cervical vertebræ with bodies nearly square.

LALAND'S WHALE (*Poescopia lalandii*).—A skeleton of this Whale is in the British Museum, and its habitat is given as Cape of Good Hope. It is the only species of the genus recorded in *Cat. Seals and Whales* by Gray, and we know of no other.

ESCHRICHTIUS.—*Gray.*

Gray establishes this genus, with the following characters, viz.: Bladebone with large coracoid process; body of the cervical vertebræ separate, small, roundish-oblong. The neural canal is very broad and high.

ROBUST HUMPBACK (*Eschrichtius robustus, Gray*).—The habitat of this species is given as North Sea, coast of Devonshire, Sweden and the Atlantic. Prof. Cope remarks: "The E. robustus

is admitted, on the evidence of a ramus of the under jaw, in the Museum, Rutgers College, which is of a peculiar form, and closely resembles the figure given by Lilljebourg of that portion of this rare species."—*Proc. Acad. Nat. Sci., Phila.*, 1868, p. 194.

FAMILY—PHYSALIDÆ.

FINNER WHALES.

This family has, at various times, borne the title *Physalina* and *Physalinidæ*. Gray, who instituted these names, has settled upon the present—*Physalidæ*. The dorsal fin stands high, erect, compressed and sickle-shaped, at about three-fourths the entire length from the nose. The pectoral fin is moderate in size, with four short fingers of four or six phalanges. The vertebral column has fifty-five or sixty-four blocks. The cervical vertebræ are not joined, or anchylosed. The neural canal is oblong and transverse.

There are some forms of this family with the vertebræ numbering sixty or sixty-four, and the first rib single-headed. The following are enumerated as such:

BENEDENIA.—*Gray*.

These Whales are characterized by having the rostrum of the skull narrow, attenuated, with straight-slanting edges; second cervical vertebra, with two short truncated lateral processes; the first rib, single-headed. The genus takes name from the naturalist, Van Beneden.—*Gray*.

KNOX'S FINNER WHALE (*Benedenia knoxii, Gray*).—This is also called B. boops by Gray, in a previous paper. Its habitat is the North Sea and coast of Wales.

PHYSALUS.—*Gray*.

The rostrum of the skull in this, the typical genus of the *Physalidæ*, is narrow, attenuated, with straight-sloping sides. The second vertebra of the cervical has a broad lateral process, with a large perforation at the base. The first rib is single-headed. The sternum is trifoliate, with a long, slender, hind process. The fingers are shorter than the fore-arm bones. The scapula is very broad; the acromion and coracoid process are well developed.

THE ANCIENT FINNER WHALE (*Physalus antiquorum, Gray*).—The term ancient, or antiquated, which we apply to this Whale, after the specific name, is probably as good as another. There is no record of the reasons for this designation. Van Beneden terms it Balænoptera musculus, and its habitat is recorded as the North Sea, Greenland, Hampshire, etc. The ribs of this species are mentioned as fourteen in number on each side.

DUGUID'S FINNER WHALE (*Physalus duguidii, Gray*).—The ribs are numbered as fifteen on each side, and the habitat is the North Sea and Orkney islands. This and the species preceding has the lateral rings of the second cervical vertebra as long as the diameter of the body of the vertebræ.

THE PATAGONIAN FINNER WHALE (*Physalus patachonicus, Gray*).—This Whale is said to inhabit the River Plata, South America. In this and the next succeeding species, the lateral rings of the cervical vertebræ are shorter than the diameter of the bodies of the vertebræ.

THE BRAZIL FINNER WHALE (*Physalus braziliensis, Gray*).—This was formerly Balænoptera of Gray, recorded as such in the *Zoölogy of the Erebus and Terror*. Its habitat is Bahia, South America. Over the name of Mr. E. Hartt, Gray quotes the following: "The first Whales appear in the Abrolhos waters at about the end of May, and they stay until October. The females often bring the young with them, and appear to seek the shelter of the reefs."

CUVIERIUS—*Gray*.

This genus, named for the eminent naturalist, has the rostrum of the skull broad, the outer sides curved, especially in front; the second cervical vertebra with two short, thick, lateral processes. The first rib is single-headed. The sternum is oblong, ovate and transverse. The hands are elongate; fingers slender, the second finger much longer than the fore-arm bone. The scapula has a broad acromion and a rudimentary coracoid.

SIBBALD'S FINNER WHALE (*Cuvierius sibbaldii, Gray*).—This is the C. latirostris of Gray, in a former paper, and Physalus sibbaldii of same author; Balænoptera of Van Beneden, and B. carolinæ and B. musculus of others. It is also called the GRAY FIN WHALE by Turner. Its habitat is given as the North Sea. Gray says: "The Great Northern Rorqual of Knox is probably of this species. Its skeleton is in the Edinburgh Museum."

RUDOLPHIUS.—*Gray*.

This is the genus Sibbaldius of Lilljebourg. Its dorsal fin is compressed, falcate, two-thirds the entire length from the nose. Ribs 13, 13; first pair short, dilated at the external end. The sternum is elongate, not narrow, at the posterior lobe. The fingers are elongate, the second finger rather shorter than the fore-arm bone. The scapula is very broad, with a large, broad acromion process and a moderate coracoid one.

THE BROAD-HEADED FINNER WHALE (*Rudolphius laticeps, Gray*).—This is named Sibbaldius laticeps by Gray, in a former paper; and Balænoptera laticeps by Van Beneden. Habitat, North Sea. The nose of the skull is more than twice the length of the brain cavity from the nasal bones.

SIBBALDIUS.—*Gray*.

This is Flowerius of Lilljebourg. The dorsal fin is very small, far behind, and placed on a thick prominence. The ribs are 14, 14; the first short, with sternal end very broad and deeply notched. The sternum is trifoliate, with a short, broad hinder lobe. The scapula is broad, with a very long acromion and short, slender coracoid process.

THE NORTHERN FINNER WHALE (*Sibbaldius borealis, Gray*).—Flowerius gigas of Lilljebourg. Habitat, North Sea. Gray gives the following note

in this connection: "Mr. Flower considers B. borealis, Cope (*Proc. Acad. Nat. Sci., Phila.*, 1866), from North Atlantic, as very nearly allied to Balænoptera schlegelii."

SCHLEGEL'S FINNER WHALE (*Sibbaldius schlegelii, Gray*).—Balænoptera schlegelii of Van Beneden. Habitat, Java. The cervical vertebræ in this species are separate. The beak of the skull is very long, being three and a half times the length of the brain cavity.

THE ANTARCTIC FINNER WHALE (*Sibbaldius* (?) *antarcticus, Gray*).—Balænoptera antarctica of Van Beneden, who regards it as a doubtful species. Habitat, Buenos Ayres.

THE SULPHUR-BOTTOM FINNER WHALE (*Sibbaldius sulphureus, Cope*).—The whalers of the north-west coast designate this species as above. Captain Scammon gives a figure and full description of the animal. The dorsal fin is very far back. It inhabits the North Pacific and North-west Coast of America, as far south as California. Sibbaldius tectirostris, Cope, inhabits the North Pacific. The skeleton is in the Museum at Philadelphia. Sibbaldius tuberosus, Cope, and S. laticeps of same author in earlier paper, inhabit the North-east Coast of North America.

FAMILY—BALÆNOPTERIDÆ.

PIKE WHALES.

The dorsal fin in this family is high, erect, compressed, about two-thirds of the entire length from the nose. The pectoral fin is moderately large, with four short fingers. The vertebræ number fifty. The cervical vertebræ are sometimes anchylosed. The neural canal is broad and trigonal. Ribs are 11, 11. The second cervical vertebra with a broad lateral expansion, perforated at the base. The first rib is single-headed. The lower jaw has a conical coronoid process.

BALÆNOPTERA.—*Gray.*

In this, the typical genus (formerly Fabricia of Gray), the lower lateral processes of the third to the seventh cervical vertebra with an angular projection on the lower edges. The fingers are short, the length of the fore-arm bone. The scapula is broad, with an acromion process and coracoid elongate and slender.

THE BEAKED PIKE WHALE (*Balænoptera rostrata, Gray*).—Habitat, North Sea. Balænoptera velifera, Cope. Has a large dorsal fin. Inhabits Oregon and California Coast and Queen Charlotte's Sound.

SWINHOIA.—*Gray.*

The lower lateral processes of the third to the sixth cervical vertebra are slender and regularly curved, without any prominent angle on the lower edge. This is an East Indian or Chinese genus, having one species, as follows:

THE CHINESE PIKE WHALE (*Swinhoia chinensis, Gray*).—Inhabits the seas of Formosa.

SECTION II.—DENTICETE.

Toothed Whales, literally, are included in this section, as distinguished from the preceding, the Mysticete, or those having only the whalebone appendage in lieu of teeth. In this section the teeth are well developed in one or both jaws, but are in some cases deciduous. The head is large, or moderately so, and compressed. There are two tympanic bones, dissimilar and separate, becoming united, and sunk in a cavity in the base of the skull. The gullet is large.

Prof. Gray arranges the sub-orders in this section which have certain relations to each other, in two parallel series. The first division has the nostrils longitudinal, parallel or diverging, and each covered with a valve; in this division is the following sub-order:

SUB-ORDER—PHYSETEROIDEA.—*Gray.*

"The head in this group is blunt; the nostrils longitudinal, parallel or diverging, and each covered with a valve; the right one is often obliterated. There are many teeth in the lower jaw, fitting into holes in the gums of the upper one. There is no distinct lachrymal bone. The costal cartilages are not ossified. The hinder ribs lose their tubercular and retaining their capitular articulation with the vertebræ. The greater number of the cervical vertebræ are anchylosed together. The pterygoid are thick, produced backwards, meeting in the middle line, and not involuted to form the outer wall of the post-palatine air-sinus. The symphysis of the mandible is either of moderate or excessive length. There are no functional teeth in the upper jaw. The teeth of the mandible are various, often much reduced in number. The lachrymal bones usually large and prominent. Bones of the skull are raised, so as to form an elevated prominence or crest behind the anterior nares. The orbit is small, or moderate in size. The pectoral limbs are small. The dorsal fin is usually present."—*Flower.*

FAMILY—CATODONTIDÆ.

The head is compressed, truncated in front and very large. The blowing-holes are separate, linear in shape, and situated in front of the head, on the upper part. The mouth is beneath, and linear in shape. The pectoral fin is short, broad and truncated. The dorsal lump is rounded. The skull elongate, crown concave, and surrounded by a high perpendicular wall, formed by the doubled-up maxilla and occipital bones. The upper jaw is toothless. The atlas is free, and the rest of the cervical vertebræ united by their bodies and spines into a consolidated mass.

CATODON.

The atlas vertebra of this genus is transverse, and nearly twice as broad as high; the central canal subtrigonal and narrow below. The skull is nearly one-third the entire length of the body.

THE GREAT-HEADED CATODON (*Catodon macrocephalus*)—Plate 27, fig. 87.—Physeter macrocephalus of Flower. Inhabits the tropical seas, and is accidentally in temperate regions. Flower regards this as identical with the C. australis. According to Maury, the Sperm Whale never doubles the Cape of Good Hope, but does pass around Cape Horn. Hence he infers that there may be a warm undercurrent off the latter point.

MEGANEURON.—*Gray.*

This genus has a sub-circular atlas vertebra, rather broader than high. The central canal sub-circular, in the middle of the body, and widened above. The rest of the animal is unknown. "It is placed among the *Catodontidæ* because this family is the only one that has the atlas separate from the cervical vertebræ, and of the simple form."—*Gray.*

KREFFT'S CATODON (*Meganeuron Krefftii, Gray*).—This is an Australian species. The atlas is given as measuring thirteen inches in width.

FAMILY—PHYSETERIDÆ.

The head in this group is depressed, and rounded in front. The blowers are linear, the left one often obliterated, and situated on the back of the forehead. The mouth is small, inferior and rounded. The dorsal fin is compressed and falcate. The skull is short, crown concave, the hinder portion of the wall formed by the maxillaries, and divided, as it were, into two sub-equal portions by a central bony ridge, which is more or less twisted towards the right side. The upper jaw is toothless. The atlas and cervical vertebræ are all united into a solid mass.

PHYSETER.—*Gray.*

The head is large and rather depressed in this, the typical form. It is only known from Sibbald's description, which, says Gray, is rather specific, as is usual with his descriptions, and are very correct. Mr. Flower doubts the accuracy of it. In the family *Physeteridæ* are three genera, viz.: Physeter, Kogia and Euphysetes. Of the first-named, one species—the only one—is an inhabitant of the North Sea. Three species belonging to the other two genera are found in the waters of Indian Ocean and Australia. Sub-order *Susuoidea* is represented wholly in India.

SUB-ORDER—DELPHINOIDEA.

The well-known Dolphins are included in this group. The characteristics are seen in the two nostrils uniting into a single central transverse or crescentic blower, on the back of the crown. The teeth are permanent in both jaws, or rarely deciduous by age. The head is generally produced in a beak-like form. The dorsal fin is sometimes wanting, and is falcate or sickle-shaped when present.

A species belonging to the genus Inia—the only one of the group—is found in the Amazon River. The family *Delphinidæ* is arranged by Dr. Gray to include tribe *Stenonina*, with nine species of genus Steno, all of the Indian Ocean and South Seas, save one from the North Sea. Genus Sotalia, with one species, is known to the waters of British Guiana. This family also includes tribes *Delphinina, Lagenorhynchina, Pseudorcaina*, and *Phocænina*. The first of these tribes embraces the familiar typical forms, the true Dolphins—Delphinus, with ten species, five being known in our American waters. The genus Clymenia includes fourteen species, two being known to waters of South America and one to the North Sea. Genus Delphinapterus has one species, common to South Atlantic and New Guinea. Genus Tursio has seven species. One is found in Philadelphia Harbor, and was described by Prof. Cope as Delphinus erebennus, and subsequently as D. tursio. One other species is known to waters of Buenos Ayres, South America. Entropia has two species in the South Seas. In the tribe *Lagenorhynchina*, genus Electra has seven species, one of which is native to the west coast of North America, named E. thicolea. Genera Feresa, Leucopleurus and Lagenorhynchus have each one species. Of tribe *Pseudorcaina*, two genera are enumerated, each having two species. Tribe *Phocænina* includes genera Phocæna, Acanthodelphis and Neomeris. Phocæna is North American, and Acanthodelphis known to Brazilian waters, each having one species only.

THE COMMON DOLPHIN (*Delphinus delphis*)—Plate 28, fig. 88.—Historical and classical, the Dolphin has in all ages claimed a good degree of interest and attention from the general reader, as well as from the poet, the painter and the *savant*. It is graceful in form, and has long been the ideal of beauty in certain artistic groupings and designs. The characteristic prominence on its head, with its prolonged snout, is exaggerated somewhat to produce the conventional art form. Yet, what with its graceful movements and attractive markings, it may well be regarded as exceptionally interesting. This is the true Dolphin of the poet and the painter, although the sailor may claim that the fish, so called, which exhibits most brilliant colors, made changeable while dying by certain aspects of the circulation of the blood, is also the true one. The latter has somewhat the same outline of head and shoulders; but the former, also, has the elongated flexible body, with the elegant forked tail, whose flukes add such grace to the drawings of ancient works. Though familiar to the reader by description and illustration, yet the Dolphin is seldom seen alive. An excellent opportunity was offered during the winter of 1878 at the New York Aquarium. A specimen, measuring about seven feet in length, was captured in the East River, New York, and was successfully exhibited alive during several months. It was regarded as much more interesting than the Beluga, or White Whale, which occupied the great tank at nearly the same time, the latter being sluggish, compared with the Dolphin, whose graceful and active manœuvres were a source of great pleasure to the many visitors. This creature is regarded by sailors as remarkably swift, and it has

accordingly been called by them the Arrow of the Sea. It also is called Sea Goose, *Oye de Mer*, on account of the peculiar contour of the head, which resembles the beak of a Goose. The Dolphin was in the earliest times consecrated to the gods, and was honored as the special benefactor of mankind. Pliny, Ælian and other ancient authors repeatedly record their appreciation of these supposed attributes. The younger Pliny wrote a charming love tale, in which the Dolphin's attachment for Hippus is set forth. Ovid sings praises of the beneficent rescue and care of the musician Arion :

> "But (past belief) a Dolphin's back
> Preserved Arion from his destined wreck;
> Secure he sits, and with harmonious strains,
> Requites his bearer for his friendly pains."

Many a pleasing tale is told, and much exaggeration is extant concerning this creature of the deep; yet there is no evidence of its possessing more sagacity than any other Cetacean. In early times the flesh of the Dolphin was highly esteemed, but it is now seldom eaten. The Dolphins are remarkably playful, and a voyage at sea is seldom without some exhibition of their gambols, or the ship unaccompanied by numbers of these "stern and bow chasers." An interesting species, though much rarer, being very seldom captured, is the Bottle-nose Dolphin.

THE PORPOISE (*Phocæna communis*).—This is the most familiar Cetacean or Whale-like animal known to our waters, although it is not often seen away from the sea shore. It is not easily captured, though it frequents nearly every bay or inlet of the coast. Its name is corrupted from the French, which originally meant Hog-fish—*Porc-poisson*. The Porpoise is about seven or eight feet in length, and its young are remarkably large at birth, like many others of this order of animals. It is gregarious, herding together, and following each other in regular lines; rolling to the surface to breathe, so exactly in line as to resemble numbers of black shining wheels.

Family GRAMPIDÆ interests us as embracing more familiar forms, of which the Grampus, so well-known to sea-faring people, is a member. Genus Grampus has three species, neither of them credited to our American waters.

Family GLOBIOCEPHALIDÆ.—This group is so named for the remarkable rounded head which gives a strikingly different aspect to the creature from that of the usual snout-bearing forms. One species is known in the harbor of Buenos Ayres—S. grayi; another, S. intermedias, was described by Cope from a specimen taken in Delaware Bay. Ten other species are known in eastern waters. Speræocephalus is another genus, closely allied, with one species, found in the British Channel.

Family ORCADÆ has two genera: Orca with eight species—one of them found in California, one in Oregon, and one on the coast of South America; and genus Ophysia, with one species, in the North Pacific.

Family BELUGIDÆ is notable for embracing the familiar form called the White Whale, and the curiously armed Narwhal. Dr. Gray records two species of the former, and mentions four other forms, which he regards as identical with B. catodon (Fig. 80, vol. i, p. 203). B. rhinodon is named by Cope as another species, found in "Arctic Seas." (*Cope, Proc. Acad. Nat. Sci., Phil.*, 1865–9.) In the same article Prof. Cope describes others, which he names B. declivis, B. augustata—each from same locality. B. canadensis is a species very common in the waters of the mouth of the St. Lawrence River. Dr. Gray regards this also as identical with B. catodon.

THE BELUGA, OR WHITE WHALE (*Beluga canadensis, Wyman*).—This Canadian species was named by Dr. Wyman of Boston, and is the one which has been so frequently captured and exhibited alive, both in New York and Boston. It is sluggish in habit, which accounts for the ease with which it is secured and transported out of its proper element. It is easily domesticated in a certain fashion. The keeper of one at Boston taught it to take its food from his hands at intervals, while it passed around the tank. A very satisfactory exhibition of this creature was afforded at Coney Island, N. Y., in the summer of 1877, where the Whale was placed in a tank built in the ground, and supplied constantly with pure sea water. This specimen was taken to Europe, but died soon after reaching the Westminster Aquarium.

THE NARWHAL (*Monodon monoceros*)—Plate 27, fig. 86.—This is indeed a unique creature. The long and single weapon which it carries in front is most surprising, as its extreme length would seem to preclude its possible utility. Yet, no doubt, it has a wise purpose. One species only is known. In most respects it is like others of its order. Though called the Sea Unicorn—the one-horn—yet it is really provided with a rudimentary associate horn, or tooth, for the long weapon is truly a tusk enormously developed. Instances are known where both tusks have developed equally, and measuring seven feet and seven and a half respectively. The great power possessed by this creature is seen in several recorded instances, where the tusk of a Narwhal had been thrust into the bottom of a vessel, and left broken near the head of the animal. The ivory of the tusk is regarded as of considerable value. To the Greenlander the Narwhal is of the greatest importance. The long tusk furnishes material for his bows, arrows and innumerable objects that wood, a scarcer article to him, is usually applied to. The upper jaw of the young, or the female Narwhal, is provided with two small and hollow tusks. In the female these remain undeveloped—they are the canine-teeth, and not incisors, as would naturally be supposed. The left tusk in the male rapidly becomes developed, but the right remains inactive, and the parts become filled with bony substance. The length of this animal is about thirteen feet, its tusk being considerably more than one half that measurement. It is common to the colder waters of both continents, and is largely gregarious. Sowerby says it accompanies ships, as do the Dolphins.

Family PONTOPORIADÆ, ranking next, is characterized by having a very long beak. One genus, with one species, is found in the South Atlantic.

SUB-ORDER—ZIPHIOIDEA.

In this group the head is produced in the form of a beak like the preceding. The teeth are only in the sides or front of the lower jaw, and fit into sockets in the upper one.

Family HYPEROODONTIDÆ includes genera Hyperoodon and Lagenocetus. A species of the first, the H. semijunctus, was described by Cope in *Proc. Acad. Nat. Sci., Phil.*, 1865. Habitat, Charlestown Harbor. One species only of the Lagenocetus is known, its habitat being in the North Sea.

Family EPIODONTIDÆ has two genera. Epiodon, the typical genus, has two species, one an inhabitant of South American waters.

Family ZIPHIIDÆ includes four genera, and is found in the British Channel. The genera Dolichodon, Neoziphius and Dioplodon are the remaining groups of this family—each with one species. The latter, D. schellensis, is a most remarkable creature, if we may judge from the skeleton, a figure of which Dr. Gray gives in the work from which we have extracted our account of the *Cetacea*. The skull is totally unlike anything of similar uses, and is increased in singularity by two horn-like processes projecting from each anterior portion of the snout. The vertebræ are enormous in comparative size, and have extremely high and broad spinous processes, while the ribs are slender and short, the whole aspect being that of a body of great muscular strength in the region of the spinal column, and one very weak or contracted in the visceral regions.

FAMILY—MANATIDÆ.

The animals arranged under this family name, in the principal portion of this work (vol. i, p. 205), are now arranged by authors in a separate order. Owen places them between the Pachyderms and Cetaceans, in order *Sirenia*. An account of their structure and habits will be found as above. This is a small but remarkable group of animals. The Seals are regarded as carnivorous marine animals; the present are herbivorous, and resemble the thick-skinned creatures of the land. They feed chiefly upon the succulent vegetables that grow upon the borders of the lakes or rivers where they reside—crawling out, like the Alligator, to sun themselves or browse upon the vegetation that grows a little removed from the shore.

THE MANATEE (*Manatus latirostris*).—This creature is nearly confined to the small area covered by the West Indian Islands and the gulf shores of Florida and Mexico. Tampa Bay, in Florida, is a favorite resort for them. The Manatees are gregarious, and at one time were very abundant. Barton records instances of great numbers being killed by the Indians of Florida. They are now comparatively rare. This species of Manatee was kept alive in Central Park, but died on the approach of cold weather. Another species, M. australis (Plate 36, fig. 84), is common to the waters of South America. A very interesting species was discovered by Steller during his voyage to Behring's Island. This has since become extinct. It is named Steller's Rhytina (R. stelleri), Plate 26, fig. 86, where a full account will be found. Another genus, the Halicore, is known in the Indian Ocean.

ORDER XIII.—MARSUPIALIA.

THIS order well-nigh belongs to another continent. a few species of Opossums, including one notable creature—the Virginia Coon, and others are known in South America.

Wallace records three genera and twenty-two species of the family *Didelphyidæ*.

The range of the true Opossums in America—and they are regarded as peculiar to this continent—is from the southern boundary of Texas to the river La Plata, and on the west coast to latitude 42° south. One species only is found above, and that extends from Florida to the Hudson River. The species is most numerous in the great forests of Brazil.

EXTINCT DIDELPHYIDÆ are found in the caves of Brazil, but none in the older formations. The living species only has been found in the Post Pliocene deposits. "In Europe many small species have been found, which are named in a distinct genus, Peratherium. They were discovered in the various Tertiary deposits, from the Upper Miocene to the Upper Eocene."—*Wallace*. This author concludes that "sufficient evidence has been shown that American Marsupials have nothing to do with those of Australia, but were derived from Europe, where their ancestors lived during a long series of ages."

THE VIRGINIA OPOSSUM (*Didelphis virginiana*)—Plate 30, fig. 96.—The 'POSSUM of the Southern States is too well known and quite too unique among other animals of our continent to require special mention. A good account of this species, with notice of several others, including the curious form called Yapock (Cheironectes variegatus), fig. 92, known in South America, may be found in vol. i, page 217.

The last remaining order embraces only the few forms called, respectively, Dutch-billed Platypus and Porcupine Ant-eaters. This order—*Monotremata*—does not, therefore, concern us, as they are all Old World animals.

HISTORY

OF

THE AMERICAN FAUNA.

BIRDS.

Family—TURDIDÆ.

THE WOOD THRUSH (*Turdus mustelinus*).—"This sweet and solitary songster," says Wilson, "inhabits the whole of North America, from Hudson's Bay to the peninsula of Florida. At whatever time the Wood Thrush arrives, he soon announces his presence in the woods. With the dawn of the succeeding morning, mounting to the top of some tall tree that rises from a low, thick-shaded part of the woods, he pipes his few but clear and musical notes in a kind of ecstasy, the prelude or symphony to which strongly resembles the double-tonguing of a German flute, and sometimes the tinkling of a small bell. The whole song consists of five or six parts, the last note of each of which is in such a tone as to leave the conclusion evidently suspended. The *finale* is finely managed, and with such charming effect as to soothe and tranquilize the mind, and to seem sweeter and mellower at each successive repetition. Even in dark, wet and gloomy weather, when scarce a single chirp is heard from any other bird, the clear notes of the Wood Thrush thrill through the drooping woods from morning till night; and it may be said truly, that the sadder the day, the sweeter his song."

The favorite haunts of the Wood Thrush are low, thick-shaded hollows, through which a small brook or rill meanders, overhung with alder bushes that are mantled with wild vines. Near such a scene he generally builds his nest. The eggs are four, sometimes five, of a uniform blue, without spots.

In America the Wood Thrush holds the first rank as a songster, and is considered to be equal to the Nightingale and Song Thrush of Europe. It is said to be easily reared in confinement, and to sing as well then as when free. Though regarded as a rare bird comparatively, it is heard in most portions of the Central Park, and it even frequents the trees overhanging the Fifth Avenue, in New York—a most exposed situation—yet the bird is with great difficulty seen.

THE HERMIT THRUSH (*Turdus pallasii*) is a species somewhat smaller than the former, but very closely resembling it. It is very secluded in habits, has no song, and its eggs are spotted; differing, therefore, from the Wood Thrush in several essential particulars. Its range of habitat is through Eastern North America to the Mississippi River.

DWARF THRUSH (*Turdus nanus*) is similar to the Hermit Thrush, but smaller, being only six and a half inches in length, with a spread of wing three and a third inches. It is confined to the Pacific Coast of North America, and along the valley of Gila and El Paso.

WILSON'S THRUSH (*Turdus fuscescens*).—This bird, called formerly by Wilson the Tawny Thrush, is like the Hermit Thrush, in so far as it has no song, but a sharp chuck. It is ten inches in length, and twelve inches in extent of wings. "This species," says Prof. Baird, "is well distinguished among the American Thrushes by the indistinctness of the spots beneath, and their being confined mainly to the fore-part of the breast."

THE OREGON THRUSH (*Turdus ustulatus*) is found on the coast region of Oregon and Washington Territories. Its length is about seven and a half inches.

THE OLIVE-BACKED THRUSH (*Turdus swainsonii*).—"This species is at once distinguished from the others by the perfectly uniform and pure dull olivaceous shade of its upper parts, most strongly marked and appreciable on the rump and tail. The throat and breast are, perhaps, more reddish than in any of our species, and the tinge in the marking on the side of the head is very much more decided than in any other; the spots on the breast larger than in T. ustulatus, and rather more numerous than in pallasii."—*Baird.* The range of this bird is from Eastern North America to the Black Hills, south to Mexico and Peru, and north as far as Greenland.

THE ROBIN (*Turdus migratorius*).—This Thrush, so well known to Americans, and especially those of the northern and eastern portions of the United States, as the Robin, has derived its name undoubtedly from the early English settlers, who found in its familiar habits, and perhaps in its color and general appearance, a semblance of the Robin-redbreast of the Mother Country. The Robin is one of the earliest songsters of the spring. Frequently in March he is seen in flocks about the fields, while the snow is yet upon the ground. His fondness for the society of man is noticeable wherever he is found: building always in the orchard or in some tree near a human

habitation. It inhabits the whole of North America, from the cold regions of the extreme north to the Gulf States, though they do not often breed farther south than Virginia. They are called by the settlers around Hudson's Bay, Red-birds; and in other northern localities the American Field-fares.

The American Robin, or Migratory Thrush, is quite a different bird from the Robin-redbreast of Europe; the latter being very much smaller and a member of another family, the *Sylviidæ*, in which belongs the Nightingale. A variety, confinis, is called Cape St. Lucas Robin.

GRAY-CHEEKED THRUSH (*Turdus aliciæ*).—This species is very nearly like the Olive-backed Thrush. It is darker than the latter; exhibits an ashy shade on the sides of the head, and a white ring around the eye. It inhabits the Mississippi region to the Missouri.

VARIED THRUSH (*Turdus nævius*) is a large bird, closely like the Robin in size, and general form and appearance. It is of the same length of the latter, but its wings and tail are somewhat shorter. It is also readily distinguished by its difference in color and markings. The Varied Thrush is nearly confined to the Pacific Coast of North America, though stragglers have been seen on Long Island and near Boston.

MOCKING-BIRD (*Mimus polyglottus*) Plate 10, fig. 34.—This, the most notable songster in America, and deservedly considered as equal to the cherished Nightingale of Europe, is an inhabitant of both North and South America, but is not found on the eastern continent. It is rarely seen in the New England States, where it is considered a straggler; though Mr. Allen, of Springfield, asserts that it has been known to breed near that place several times. In one instance, he remarks, "the pair was secured, with the nest and eggs." Of the bird, Wilson says: "Though rather a shy bird in the Northern States, here he appeared almost half domesticated, feeding on the cedars, and among the thicket of smilax that lined the roads, while I passed within a few feet; playing around the planter's door, and hopping along the shingles." The Mocking-bird breeds more freely in the Middle States; in April he is seen to be preparing his nest in the Gulf States. In Pennsylvania he bestirs himself for this event during the first week in May; and still later in New York and the more northern limits of its range. He is like the Robin, fond of the cultivated thickets near human habitations, and builds, usually, quite near them. Describing the general appearance of this bird, Wilson says: "The plumage of the Mocking-bird, though none of the homeliest, has nothing gaudy or brilliant in it, and, had he nothing else to recommend him, would scarcely entitle him to notice; but his figure is well proportioned, and even handsome. The ease, elegance and rapidity of his movements, the animation of his eye, and the intelligence he displays in listening and laying up lessons from almost every species of the feathered creation within his hearing, are really surprising, and mark the peculiarity of his genius. To these qualities we may add that of a voice full, strong and musical, and capable of almost every modulation, from the clear, mellow tones of the Wood Thrush to the savage scream of the Bald Eagle. In measure and accent he faithfully follows his originals. In force and sweetness of expression, he greatly improves on them. In his native groves, mounted on the top of a tall bush or half-grown tree, in the dawn of dewy morning, while the woods are already vocal with a multitude of warblers, his admirable song rises preëminent over every competitor. The ear can listen to *his* music alone, to which that of all others seems a mere accompaniment. Neither is this strain altogether imitative. His own native notes, which are easily distinguished by such as are well acquainted with those of our various song birds, are bold and full, and varied seemingly beyond all limits. They consist of short expressions of two, three, or at most five or six syllables, generally interspersed with imitations, and all of them uttered with great emphasis and rapidity, and continued, with undiminished ardor, for a half an hour or an hour at a time. His expanded wings and tail, glistening with white, and the buoyant gayety of his action, arresting the eye, as his song most irresistibly does the ear, he sweeps round with enthusiastic ecstasy —he mounts and descends as his song swells or dies away, and, as my friend Bartram has beautifully expressed it, 'He bounds aloft with the celerity of an arrow, as if to recover or recall his very soul, expired in the last elevated strain.' While thus exerting himself, a bystander destitute of sight, would suppose that the whole feathered tribes had assembled together on a trial of skill, each striving to produce its utmost effect, so perfect are his imitations." We have quoted very fully from Wilson's delightful account of this bird, feeling that the reader can nowhere find a more truthful or interesting recital. One domesticated Mocking-bird of our acquaintance *neighed* in close imitation of a Horse; and another mocked the weird notes of the Whip-poor-will. On the Florida reef this bird makes its appearance in considerable numbers for a few days at a time during the winter months, but is always entirely *silent* there. We have often received familiar visits from them within the enclosed veranda, and even in the house interior, where they would accept the proffered food, but have never uttered a note.

THE CAT-BIRD (*Mimus carolinensis*)—Plate IV, fig. ii.—This is one of the most familiar of our native birds, known to all the country-side of the Northern States by its characteristic cat-like notes. Both male and female have the habit, besides the utterance of song like that of the Brown Thrush, of producing notes like the *mewing* of a Cat. The Cat-bird is one of the first visitors in spring. It breeds in New England and the Northern States, as far west as the Missouri River. It is, like the Robin and Mocking-bird, fond of human society, if we may judge from its almost invariable custom in frequenting the settled neighborhoods. It builds its nest and lays about the last week in May, or first in June, and has four to five eggs of a bright, deep, emerald green. To a certain extent, the Cat-bird is a mocker;

he tries his voice in imitation of the various songsters, and being one of the earliest in the summer morning concerts, he is particularly prominent; yet he is but an indifferent melodist. Wilson, whose kindly feelings are always on the side of our birds, thus defends the Cat-bird: "With all his amiable qualities, few people in the country respect the Cat-bird; on the contrary, it is generally the object of dislike, and the boys of the United States entertain the same prejudice and contempt for this bird, its nest and young, as those of Britain do for the Yellow Hammer. I am at loss to account for this cruel prejudice. Even those by whom it is entertained can scarcely tell you why; only, they 'hate Cat-birds,' as some persons tell you they 'hate Frenchmen,' they 'hate Dutchmen,' etc.: expressions that bespeak their own narrowness of understanding and want of liberality. The Cat-bird is fond of large, ripe garden strawberries; so is the farmer. The Cat-bird loves the richest and best early cherries; so does the farmer. The Cat-bird has a particular partiality for the finest, ripe, mellow pears; and these, also, are particular favorites of the farmer. But the Cat-bird has frequently the advantage, by snatching off the first-fruits of these delicious productions; and the farmer takes revenge by shooting him down, as he finds old hats, wind-mills and scare-crows are no impediments in his way to those forbidden fruits. The boys are now set to watch the cherry-trees with the gun; and thus commences a train of prejudices and antipathies that commonly continue through life. Perhaps, too, the common note of the Cat-bird, so like the mewing of the animal whose name it bears, and who itself sustains no small share of prejudice, the homeliness of his plumage, and even his familiarity, so proverbially known to beget contempt, may also contribute to this mean, illiberal and persecuting prejudice. But with the generous and the good, the lovers of nature and of rural charms, the confidence which this familiar bird places in man by building in his garden, under his eye, the music of his song, and the interesting playfulness of his manners, will always be more than a recompense for all the little stolen morsels he snatches." All honor to the memory of the kindly heart that prompted, and the cultured, poetic mind that gives us such biographies of our charming native birds!

MOUNTAIN MOCKING-BIRD (*Oroscoptes montanus*).—This bird, described by Audubon as the Turdus montanus, and by Bonaparte as Mimus montanus, is an inhabitant of the Rocky Mountains, ranging to the southward as far as Mexico, and westward to California. Its length is eight inches.

THE CALIFORNIA THRUSH (*Harporhynchus redivivus*.—This species, found on the coast of California, has a very long and curved bill. The wing is peculiar, being much rounded in its outline.

LECONTE'S THRUSH (*Harporhynchus lecontii*).—The bill in this species is also considerably curved. In general appearance it closely resembles the last named, but is smaller. Its habitat is near Fort Yuma, California.

CURVED-BILL THRUSH (*Harporhynchus curvirostris*).—This species is distinguished from the California Thrush by its smaller size, shorter tail and white under parts with distinct spots, etc. Habitat, Lower Rio Grande.

MEXICAN THRUSH (*Harporhynchus longirostris*). is a species resembling the Brown Thrush of the Northern States, yet considered to be distinct and easily recognized by certain characters. It is found on the Lower Rio Grande, and south through Eastern Mexico.

BROWN THRUSH (*Harporhynchus rufus*).—Through Eastern North America this bird is well known as a pleasant songster. He is variously called Thrasher, Brown Thrush, Fox-colored Thrush, Ferruginous Thrush, and, in the Southern States, the French Mocking-bird. Its tones are much like those native to the Mocking-bird. In the early days of the Republic, the latter was called the English Mocking-bird, while the Brown Thrush, being somewhat inferior in voice, was designated as the French Mocking-bird—our forefathers, through strong prejudice, considering everything French as inferior. The Brown Thrush is the largest of this family. He is usually seen in the Northern States about the last week in April. Wilson says of this bird: "The Thrasher is a welcome visitant in spring to every lover of rural scenery and rural song, which is first heard in the months of April and May, when our woods, hedge-rows, orchards and cherry-trees are one profusion of blossoms." The Brown Thrush is easily reared, and sings well in confinement.

FAMILY—CINCLIDÆ.

AMERICAN DIPPER; WATER OUZEL (*Cinclus mexicanus*).—This bird, having a range from British America to Mexico, along the line of the Rocky Mountains, was described by Audubon as Cinclus americanus. It is allied to the Thrushes, but has curious habits which lead it to frequent running streams of water. Dr. Coues, U. S. A., has lately given us, in *The American Sportsman*, Jan. 7th, 1874, an interesting account of the species and its nest, as follows: "It may seem singular to speak of a Thrush-like bird living in the water, but such is exactly true in this case. Although not web-footed, nor able to swim with its feet, nor having the slightest affinity with water birds, as is generally understood, nevertheless, there is no Duck or Diver more truly aquatic than the Dipper; a great part of its time, in fact, being spent under water, where it repairs in search of food. The question naturally arises how, if it cannot swim, it stays there, or gets there at all? It *flies* down into the water, and flies about under the surface, using its wings just as in ordinary flight. In the transparent brawling brooks it loves to frequent. We may see it, at times scrambling along near the bottom, heading always up stream, holding the body inclined forward and downward, beating its wings, and so tripping along just over the bottom of the brook. It seems to have some difficulty in keeping down, for the moment its exer-

tions are relaxed it comes to the surface, sometimes being swept along for a considerable distance by the force of the current. It *may* gather food in a more usual manner, but, in any event, most of its subsistence is derived in this way from the water.

"The birds of this group, *Cinclidæ*, are the only instances we have among the higher birds of truly aquatic habits. They are all odd-looking creatures, short and puffy, with a short tail, looking as if it had been cut off; short, rounded, concave wings, and rather stout feet. The plumage is exceedingly soft and thick, to resist the water, something like that of a Duck's breast, only much finer. Our species is of a nearly uniform leaden-gray all over, and about as large as a Blue-bird, though appearing much stouter. The bird lives always close by the water, in the roar of the cascade, and the purling of the stream, haunting the stony banks that are slippery with moisture; and, where the moss grows greenest, in the spray of the waterfall, it builds its elegant home—an imposing mansion, indeed, for such a plain-looking little bird. The nest is a great globe of living moss, some thirty inches in circumference, on a slab of stone, or in a crevice of a stranded stump, but always close by the water's edge. The entrance is a neat doorway, made by a special arrangement of the moss in the shape of a hole in one side, no larger than is sufficient to admit of easy passage. Inside, this ball is lined with fine grasses, keeping it snug, dry and warm; and in one season it contained four or five pure white eggs." The doctor adds some pleasant remarks about the aspect of this curious nest. The bird, frequenting the water as it does constantly, naturally shakes herself as she alights upon the mossy nest; this results in a sprinkling from the wet plumage, and consequently a freshening of the green moss patches. This bit of biography is exceedingly entertaining, and is a valuable addition to the history of our American birds.

FAMILY—SAXICOLIDÆ.

STONE CHAT (*Saxicola œnanthe*) is an accidental visitor in America. It is occasionally seen in Greenland, but is common in Europe, where it is called the Wheat-ear. See vol. i, page 326.

BLUE-BIRD (*Sialia sialis*).—This beautiful bird is one of the earliest to arrive from its winter sojourn at the South. About the middle of March, and sometimes earlier, it is seen in the Northern States; and in October, about the last of the month, it again leaves for the South. Wilson says of him: "The pleasing and sociable disposition of this little bird entitles him to particular notice. As one of the first messengers of spring, bringing the charming tidings to our very doors, he bears his own recommendation always along with him, and meets with a hearty welcome from everybody. The usual spring and summer song of the Blue-bird is a soft, agreeable and oft-repeated warble, uttered with open, quivering wings, and is extremely pleasing. In his motions and general character he has great resemblance to the Robin-redbreast of England, and had he the brown-olive of that bird, instead of his own blue, could scarcely be distinguished from him."

CALIFORNIA BLUE-BIRD (*Sialia mexicana*).—This species seems to be to the Pacific Coast what S. sialis is to the eastern. The latter is not seen far west of the Missouri River, and the Western Blue-bird is confined to the western slope. Prof. Baird says: "The shade of blue in this species is much as in the common eastern species, only brighter and more intense. The bill is more slender and the wings longer." This bird was described by Audubon as Sylvia occidentalis.

ROCKY MOUNTAIN BLUE-BIRD (*Sialia arctica*).—This species was described by Audubon as Sylvia arctica. It is of a lighter blue than the other species, and has no brown shade. "The bill is much stouter than in mexicana, as well as longer than in sialis. The wings, also, are longer in proportion, reaching nearly to the end of the tail, which is more deeply forked than in either of the others. It inhabits the high, dry central plains in Upper Missouri to Rocky Mountain range and south to Mexico. Rare on the coast of California."—*Baird.*

ALASKA WILLOW WARBLER (*Phyllopneusts borealis*).—A single specimen of this species was found in 1866 on St. Michael's Island, Norton's Sound, Alaska. It closely resembles the Willow Wren of Europe.

FAMILY—SYLVIIDÆ.

RUBY-CROWNED WREN (*Regulus calendula*).—This little creature is a visitor in the Northern States about the middle of April. It winters in the southern part of the Union, and passes on to Canada and Labrador to breed about the middle of May. In the fall it again visits us; and it proves an acceptable sojourner, both for its song and for its services in the destruction of insects. It ranges through the whole country, from the Atlantic to the Pacific, and from Mexico to Alaska. It is four inches in length and six in extent of wing.

GOLDEN-CRESTED WREN (*Regulus satrapa*).—This species so closely resembles others found in every quarter of the globe that, for a time, it was considered to be the same species. Audubon regards it as differing from the R. cristatus of Europe, in being considerably longer, with the bill decidedly shorter and the flame-colored patch on the head more extended. Prof. Baird compares a specimen of the European species, and finds the "wing of the latter rather longer, and the bill considerably shorter." Dr. Brewer, in his edition of *Wilson's Ornithology*, says: "This very hardy and active tribe, with one exception, inhabits the temperate and northern climates, reaching even to the boundaries of the arctic circle. They are migratory in the more northern countries, and though some species are able to brave our severest winters, others are, no doubt, obliged, by want of food and a lower degree of cold, to quit the rigors of northern latitudes." The Golden-crest is about the same size as the Ruby-crowned. It has on the crown of the head two black bands or lines,

extending over the occiput; between these, lies a bed of glossy golden-yellow, which, being parted a little, exposes another of a bright flame color, extending over the whole upper part of the head.

CUVIER'S GOLDEN CREST (*Regulus cuvieri*).—This species is given on the authority of Audubon, who procured a single specimen in Pennsylvania. No other specimen has been found in the United States.

BLUE-GRAY FLY-CATCHER (*Polioptila cœrulea*).—Under the title Muscicapa cerulea, Wilson describes this bird. He says: "This diminutive species, but for the length of its tail, would rank next to the Humming-birds in magnitude. It is an active insect catcher, searching, usually, the topmost branches of the tallest trees, and uttering its low, feeble chirp, *Tsee! tsee!* Its length is four inches and a half, and extent of wing six inches and a half." A species of this genus is described and named by Prof. Baird as Polioptila plumbea. It is a trifle larger than the preceding. It is found in the valley of the Colorado and in the Gila. Another species is described by Mr. Lawrence as P. melanosa, Law, from the valley of the Rio Grande and Gila, west to San Diego.

FAMILY—CHAMÆADÆ.

GROUND TIT (*Chamæa fasciata*).—This rather new bird is confined to the California coast; it is regarded as resembling both the Wrens and Titmice. Its white iris distinguishes it from others.

FAMILY—PARIDÆ.

TUFTED TITMOUSE (*Lophophanes bicolor*).—Described by Wilson as Crested Titmouse (Parus bicolor). It is found all over the United States, but is more numerous at the North. It extends to Hudson's Bay, and, according to Latham, is found in Denmark and in the southern parts of Greenland. It is six inches long, and seven and a half in extent of wing.

BLACK-CRESTED TIT (*Lophophanes atricristatus*).—This is a smaller species than the preceding, found in the valley of the Rio Grande and South. Two other species are found in North America: Lophophanes inornatus, on the coast of California and Southern Rocky Mountains; and Lophophanes wollweberi, Southern Rocky Mountains, and south into Mexico on the Table-lands. "The latter is much more like the European L. cristatus than any other American Titmouse."—*Baird.*

LONG-TAILED CHICKADEE (*Parus septentrionalis*).—"This species is similar in general characters to the P. atricapillus, but is considerably larger, with proportionately longer tail. Missouri River to the Rocky Mountains."—*Baird.*

BLACK-CAP TITMOUSE (*Parus atricapillus*).—"This is one of our resident birds; active, noisy and restless; hardy beyond any of his size, braving the severest cold of our continent as far north as the country round Hudson's Bay, and always appearing most lively in the coldest weather. The males have a variety of very sprightly notes, which cannot, indeed, be called a song, but rather a lively, frequently repeated, and often varied twitter. They are most usually seen in the fall and winter, when they leave the depths of the woods, and approach nearer to the scenes of cultivation. At such seasons they abound among evergreens, feeding on the seeds of the pine-tree."—*Wilson.*

WESTERN TITMOUSE (*Parus occidentalis*).—This is a species from the North Pacific Coast of the United States. "Is of the same size as P. atricapillus, and resembles it in its markings."—*Baird.* From Eastern Mexico, another Titmouse is recorded as Parus meridionalis. The Carolina Titmouse (P. carolinensis) was described by Audubon by the present name. It is found in the South Atlantic States as far as Washington. It is very similar to the P. atricapillus, but is smaller. The P. montanus is an inhabitant of the Pacific Coast. The Chestnut-backed Tit (P. rufescens) is another Pacific Coast species. Parus hudsonicus is found in the north-eastern portions of North America to the Atlantic States. "It is quite different from the other American Titmice, though most resembling P. rufescens."—*Baird.*

BLACK-CHEEKED TIT (*Psaltiparus melanotis*).—This species is from the Rio Grande and Eastern Mexico.

LEAST TIT (*Psaltiparus minimus*).—Described by Audubon as Parus minimus. It is truly a *tit-bit* of a bird, only four inches in length, and its wing less than two inches. Habitat, Pacific Coast of United States. A species from the Southern Rocky Mountains has been described by Prof. Baird as P. plumbeus. An allied form is from the Rio Grande and valleys of Mexico and Texas—the Paroides flaviceps.

YELLOW-HEADED BUSH TITMOUSE (*Auriparus flaviceps*).—Mr. Geo. N. Lawrence has lately added this little species to our Fauna. It is abundant in the region of Cape St. Lucas. Dr. Cooper found it rather common in California during the winter months, as well as at other seasons. The song of this bird resembles the Chickadee, and in habits it is said to be like the Titmice and Warblers. Its length is four and a half inches, with extent of wing two and a sixteenth.

WHITE-BELLIED NUTHATCH (*Sitta carolinensis*).—This bird is found in New England and the Northern States during winter. It derives its name, Nuthatch, from a supposed habit of breaking nuts by thumping them with its bill. It ranges from the eastern portion of North America to the high central plains, where it is replaced by another species—the Sitta aculeata or SLENDER-BILLED NUTHATCH—whose habitat is the Pacific Coast, and eastward to the Rocky Mountains. The RED-BELLIED NUTHATCH, S. canadensis—(S. varia of Wilson)—is another species common to the eastern portion of America. It is much smaller than the others, measuring only four inches and a half in length. These birds are exceedingly active and useful in ridding the shade and fruit-trees of insects and their larvæ. The

BROWN-HEADED NUTHATCH (S. pusilla) is a resident of the South Atlantic and Gulf States. The California Nuthatch (S. pygmæa) resembles closely the latter species. It is found along the Pacific Coast and the Rocky Mountain region. It is much smaller than the other species, being only four inches in length, and two and a half inches in alar extent.

BROWN CREEPER (*Certhia familiaris*).—This bird so closely resembles the European that it is regarded as only a variety, which has been called var. americana. In the southern portion of New England it is common throughout the year. It is found all over the continent, from Mexico to high northern latitudes. Near Boston these birds are seen during the winter months, when they approach very closely the dwellings for food. A variety, mexicana, is found in the south-western portion of the United States and Mexico.

FAMILY—TROGLODYTIDÆ.

CACTUS WREN (*Campylorhynchus brunneicapillus*.—This is also called the BROWN-HEADED CREEPER. It is a comparatively recent addition to our Avifauna, though found quite abundant on the south-western borders of the United States, where it frequents the cactus-plants for food.

CAPE CACTUS WREN (*C. affinis*) is closely allied to the preceding, and is not known away from the California coast at Cape St. Lucas.

ROCK WREN (*Salpinctes obsoletus*).—This little bird is distinguished by being alone in the genus. It is confined to the high rocky lands between Oregon and Mexico.

CANON WREN (*Cathcrpes mexicanus*).—This species was added to our Fauna by Dr. Heermann, in 1851. It is regarded as the handsomest in its markings. Its range is along the Mexican boundary, up the Colorado to Nevada. This form is called var. conspersus, and the White-throated Rock Wren.

GREAT CAROLINA WREN (*Thryothorus ludovicianus*).—This is the Certhia caroliniana of Wilson. It is common to the Southern States as far north as Pennsylvania. It is also called Mocking Wren from its wonderful imitative powers. A variety, T. berlandieri, is found on the Rio Grande. Bewick's Wren (T. bewickii) is found in all portions of the United States. Another variety, T. spilurus, is found along the Pacific slope of the United States.

HOUSE WREN (*Troglodytcs ædon*).—This is also called WOOD WREN. It is one of the most familiar of our native birds, and a great favoritc. Its remarkable industry and cheerfulness, and its pleasant song, claim for it a welcome in the orchard or garden. It inhabits all of the States, and is migratory.

PARKMAN'S WREN (*T. ædon, var. parkmani*).—Called, also, WESTERN WOOD WREN. It is confined to the region west of the Mississippi.

WINTER WREN (*T. parvulus*).—The variety hyemalis is regarded as closely like the Common Wren of Europe (T. parvulus). It is common to all portions of North America, yet not abundant in any locality. A form is found in Alaska, which is regarded as a variety—T. alascensis.

SHORT-BILLED MARSH WREN (*Cistothorus stellaris*).—This is irregularly distributed from Georgia to the British Provinces. It frequents the low marshy grounds.

LONG-BILLED MARSH WREN (*C. palustris*).—Two varieties are noted by Baird. The palustris is common to the Eastern United States, and the other, paludicola, is confined to the Pacific Coast.

FAMILY—MOTACILLIDÆ.

THE WAGTAILS.

WHITE WAGTAIL (*Motacilla alba*).—This is the Common Wagtail of Europe; individuals, however, are found in Greenland.

YELLOW WAGTAIL (*Budytes flava*).—This is the same as the species found in Europe and Asia; certain specimens having been obtained in Alaska, give the species a footing in our Fauna.

TITLARK (*Anthus ludovicianus*)—called by Wilson the BROWN LARK—is found in North America generally. Another name in use is Pipit, or American Pipit. Dr. Coues observed this bird rather minutely, and gives it credit for a very sweet voice. It moves like the true Larks, jerking its tail in the manner of the Water Thrushes and Wagtails.

EUROPEAN PIPIT (*Anthus protensis*).—Though a European species, some specimens have been observed in Greenland. It is remarkable for its efforts at deception when approached during the breeding season.

MISSOURI SKYLARK (*Neocorys spraguei*).—Called, also, SPRAGUE'S PIPIT. It bears a general resemblance to the Titlark. Audubon described the species from specimens obtained on the Upper Missouri. It resembles closely the European Skylark.

FAMILY—SYLVICOLIDÆ.

BLACK AND WHITE CREEPING WARBLER (*Mniotilta varia*).—This is a common bird in the Eastern States, where it is usually seen creeping nimbly over the surfaces of the trunk and branches of forest-trees, in search of insects. It extends southward to Guatemala, and west to the Missouri River.

PROTHONOTARY WARBLER (*Prothonotary citrea*).—This is abundant in the swamps of Louisiana and Mississippi, where it seeks insect food. Stragglers are found as far north as Southern Illinois.

WORM-EATING SWAMP WARBLER (*Helmitherus vermivorus*).—This is a rare bird in the North-eastern States. It inhabits the interior of deep forests, and is seldom seen in the open fields.

In the South Atlantic States a species is known as Swainson's Warbler (H. swainsonii).

GOLDEN-WINGED WARBLER (*Helminthophagà chrysoptera*).—This is not a common species. It is found occasionally from Georgia to Massachusetts, and westward to Missouri. H. bachmanii is a rarer bird. It is found on the coast of South Carolina, and in Cuba in winter. H. Pinus, the Blue-winged

Yellow Warbler, is rare in New England, but abundant in Southern States.

NASHVILLE WARBLER (*H. ruficapilla*).—This was regarded for a long time as a very rare bird. It has lately been observed as quite common in various portions of New England.

ROCKY MOUNTAIN WARBLER (*H. virginiæ*).—This is called, also, VIRGINIA'S WARBLER, in honor of Dr. Anderson's wife, Virginia. Dr. A. first discovered it in New Mexico, in 1859.

LUCY'S WARBLER (*H. luciæ*) is a new Warbler, found by Dr. Cooper in California and Arizona.

THE ORANGE-CROWNED WARBLER (*H. celata*) is found in the interior regions of North America. A Pacific variety, H. lutescens, is common to the coast.

TENNESSEE WARBLER (*H. peregrina*).—This is regarded as having an inappropriate name, its range being far from the State from whence its name comes. In summer it is common in the New England States.

BLUE YELLOW-BACKED WARBLER (*Parula americana*).—This is common in the Eastern States and west to the Mississippi, and breeds in the same regions. Its habits are similar to the Titmice.

CAPE MAY WARBLER (*Perissoglossa tigrina*).—This is rare, but distributed throughout the United States, excepting the south-western portion. It breeds in Cuba and in Jamaica.

CARBONATED WARBLER (*Perissoglossa carbonata*).—Audubon procured two specimens of this bird near Henderson, Ky., in 1811, and none have since been seen.

YELLOW WARBLER (*Dendroica æstiva*).—A very abundant species, and found in all parts of the Union, from the Atlantic to the Pacific.

YELLOW-RUMP WARBLER (*D. coronata*).—In the spring and fall this is very common in the Northern States. It breeds in the most northern portions.

AUDUBON'S WARBLER (*D. auduboni*).—A Pacific Coast bird, extending to the Rocky Mountains, and southward to Mexico.

THE BLACK-AND-YELLOW WARBLER (*D. maculosa*) is common in the Eastern States, and as far west as the Missouri River. The CERULEAN WARBLER (*D. cerulea*) is an eastern species. The BLACKBURNIAN WARBLER is the most beautiful of all the species. It is rare in the east, though it has been seen to breed there. Verrill says it breeds in Maine. Wilson says: "It is an active, silent bird." Audubon differs in his account. He says: "It has a very sweet song of five or six notes, much louder than seems possible for so small a bird."

THE YELLOW-THROATED GRAY WARBLER (*D. dominica*) is very little known in the Northern States.

CHESTNUT-SIDED WARBLER (*D. pennsylvanica*).—This pretty bird is found in the Eastern Province of the United States, in the Bahamas, and as far south as Costa Rica. It breeds in Massachusetts and northward. It is quite common in Eastern Massachusetts. Wilson and other early naturalists knew but little of the species. Its nest is often found in the barberry-bushes of the Eastern States. D. graciæ, the ARIZONA WARBLER, is a western species.

BLACK-POLL WARBLER (*D. striata*).—The range of this warbler is from the Eastern Province of all North America to the Arctic Ocean. It is found in Cuba and the Bahamas in winter. Its late arrival in the Eastern States earns for it the title "harbinger of summer." It is abundant, but is not known west of the Great Plains.

BAY-BREASTED WARBLER (*D. castanea*).—This is a rare bird in New England, and, indeed, everywhere so, though distributed from the Atlantic to the Great Plains, and from Hudson's Bay to the Gulf of Mexico. Verrill and Boardman recognize it in Maine.

BLACK-THROATED BLUE WARBLER (*D. cærulescens*).—This is an inhabitant during the warmer months of the Eastern Province, and in winter of Cuba, Jamaica and Bahamas. "They often utter a faint, drawling *wéesy, wéesy*, and occasionally a louder chirp, or *chink*, like that of the Nashville Warbler."—*Samuels.*

OLIVE-HEADED WARBLER (*D. olivacea*) is a native of Mexico and Guatemala; but very little is known of its habits.

BLACK-THROATED GRAY WARBLER (*D. nigrescens*).—Inhabits the Western and Middle Provinces of the United States, and is migratory to Mexico.

YELLOW-CHEEKED WARBLER (*D. chrysoparcia*).—This is a newly-described bird, and is admitted to our Fauna on the authority of Dr. Heermann, who found one in Texas.

BLACK-THROATED GREEN WARBLER (*D. virens*).—A beautiful species, common in the Northern States. "Its song is like the syllables *ta-tee-te, it-tă-tee*, uttered in a plaintive tone. It is peculiar, and cannot be confounded with that of any other Warbler in New England."—*Samuels.*

TOWNSEND'S WARBLER (*D. townsendi*).—Habitat, Western Province of the United States, north to Sitka, and migratory to Mexico and Guatemala. Rare.

WESTERN WARBLER (*D. occidentalis*).—The range of habitat of this bird is much the same as that of the preceding. Ridgway met it in the East Humboldt Mountains, and records its note as "a lisped *pzeet.*"

PINE-CREEPING WARBLER (*D. pinus*).—This is a very early visitor, often arriving north before the wintry weather has ceased. "They are, in the summer, almost always observed in the pine-groves, actively traversing the limbs and branches, sometimes with the movement of the Creepers and Titmice, and at others like the Warblers, and often seizing insects on wing, like the Fly-catchers."

BLUE MOUNTAIN WARBLER (*D. montana*).—The habitat of this species is given as: "Blue Mountains of Virginia." It is only known through the descriptions of Wilson, Audubon and Vieillot. Its song is said to be a single *screep!* three or four times repeated.

KIRTLAND'S WARBLER (*D. kirtlandi*).—Northern Ohio and the Bahamas are the localities given as the habitat of this bird. It is regarded as one of the rarest of American birds. Only three or four specimens have been obtained: one, the type specimen, in the Smithsonian Institute; and a second was captured by Dr. Cabot at sea, near Cuba.

YELLOW-RED-POLL WARBLER (*D. palmarum*).—"This little bird arrives in Pennsylvania early in April, while the maples are yet in blossom. * * * It feeds upon the stamens and insects found on them. Low, swampy thickets are the favorite resort."—*Wilson.* Mr. Boardman, of Calais, says: "It is one of our most common Warblers, and, unlike others, it spends much of its time feeding upon the ground. In the fall we find them feeding with the Snow-birds (Junco hyemalis)."

PRAIRIE WARBLER (*D. discolor*).—One of the most beautiful of the group. It is rare in New England, and is not common north of New York. The nest is remarkable for its beauty and complex structure.

GOLDEN-CROWNED THRUSH (*Seiurus aurocapillus*).—Called, also, OVEN-BIRD, from the fact that it builds a cover to its nest, and leaves an opening at the side, in the manner of an oven-builder. It is common in all the Northern States in summer, and attracts by its great beauty and interesting habits.

SMALL-BILLED WATER THRUSH (*S. noveboracensis*).—This is the Turdus aquaticus of Wilson. It is commonly seen in the brooks and small streams, where it wades for its food—aquatic insects—wagging its tail almost constantly; hence, it is called in some regions WATER WAGTAIL.

LOUISIANA WATER THRUSH (*S. ludovicianus*).—This is larger than the preceding. It is found in the Eastern Province as far north as Pennsylvania, and reaches south as far as Mexico.

MARYLAND YELLOW-THROAT (*Geothlypis trichas*).—Sylvia of Audubon, S. marylandica of Wilson. "This is one of the humble inhabitants of the briars, brambles, alder-bushes, and such shrubbery as grows most luxuriantly in low, watery situations; and might with propriety be denominated *Humility*, its business or ambition seldom leading it higher than the tops of the underwood. Insects and larvæ are its principal food. It inhabits the whole United States, from Maine to Florida. It seldom approaches the farm-house, though by no means shy in its retreat."—*Wilson.* A species is found in the West Indies and in South America, the GRAY-HEADED WARBLER—(G. velatus)—Trichas delafieldi of Audubon. The MOURNING WARBLER (G. philadelphia) is rarely seen in New England, though it is occasionally in Greenland, and as far west as Missouri. MACGILLIVRAY'S WARBLER (G. macgillivrayi) is found on the Pacific Coast and in the Rocky Mountains.

CONNECTICUT WARBLER (*Oporornis agilis*).—Sylvia agilis of Wilson. A rare bird in the New England States. "Habitat, Eastern United States. Very rarely seen."—*Baird.* The KENTUCKY WARBLER (O. formosus) is found throughout Eastern United States, west to Fort Riley. It is more common in the Southern States.

YELLOW-BREASTED CHAT (*Icteria viridis*).—The description of this bird and its habits by Wilson is so graphic, one may easily imagine himself, for the time being, transferred to its secluded retreat. "When he has once taken up his residence in a favorite situation, which is almost always in close thickets of hazel, brambles, vines and thick underwood, he becomes very jealous of his possessions, and seems offended at the least intrusion; scolding every passenger as soon as they come in view, in a great variety of odd and uncouth monosyllables, which it is difficult to describe, but which may be readily imitated, so as to deceive the bird himself, and draw him after you for a quarter of a mile at a time, as I have sometimes amused myself in doing, and frequently without once seeing him. On these occasions his responses are constant and rapid, strongly expressive of anger and anxiety; and, while the bird itself remains unseen, the voice shifts from place to place among the bushes, as if it proceeded from a spirit. First is heard a repetition of short notes, resembling the whistling of the wings of a Duck or Teal, beginning loud and rapid, and falling lower and slower, till they end in detached notes; then, a succession of others, something like the barking of young Puppies, is followed by a variety of hollow, guttural sounds, each eight or ten times repeated—more like those proceeding from the throat of a quadruped, than that of a bird—which are succeeded by others not unlike the mewing of a Cat, but considerably hoarser. All these are uttered with great vehemence, in such different keys, and with such peculiar modulations of voice, as sometimes to seem at a considerable distance, and instantly as if just beside you; so that, from the manœuvres of ventriloquism, you are utterly at loss to ascertain from what particular spot or quarter they proceed." This Chat is seen in the Eastern United States, and westward as far as Missouri, southward to Guatemala. A species, found on the high central plains of the United States to the Pacific, and southward into Mexico, has been named by Mr. G. N. Lawrence, Long-tailed Chat (Icteria longicauda).

HOODED WARBLER (*Myiodioctes mitratus*).—An extremely rare bird in New England. Audubon says of it: "The Hooded Fly-catcher is one of the liveliest of its tribe and is almost continually in motion. Fond of secluded places, it is equally to be met with in the thick cane-brakes of the high or low lands, or amid the rank weeds and tangled rushes of the lowest and most impenetrable swamps. You recognize it instantly on seeing it, for the peculiar graceful opening and closing of its broad tail distinguishes it at once, as it goes on gambolling from bush to bush, now in sight, now hidden from your eye, but constantly within hearing." Habitat, Eastern United States to the Missouri River, south to Guatemala.

THE SMALL-HEADED FLY-CATCHER (*M. minuta*) is a very rare bird. Wilson met with one only. Prof. Baird says: "I have never seen a specimen, and copy the description from Audubon." Habitat, Eastern Atlantic States.

GREEN BLACK-CAP FLY-CATCHER (*M. pusillus*).—This is a rare bird in New England, though common farther north. Its habits are in striking contrast to some of the preceding species. This bird, according to Audubon, is not very rare in Maine, and it becomes more abundant the farther north we proceed. Ridgway records a variety, M. pileolatus, from the Pacific Coast.

THE CANADA FLY-CATCHER (*M. canadensis*).—A handsome species, common in New England in the spring and fall, and in the more northern regions remaining all summer. It is found as far west as the Mississippi River. A more southern species is named Bonaparte's Fly-catcher (M. bonapartii).

RED START (*Setophaga ruticilla*).—A common species in New England and the Northern States generally, in summer. It is a handsome bird; its orange-colored epaulets and vermilion-shaded breast give it a showy appearance. Its note is a shrill *Chewéea!* uttered at intervals of a half to a whole minute. The PAINTED FLY-CATCHER (T. Picta) is a Mexican species; and the RED-BELLIED FLY-CATCHER (T. miniata) is from the same locality, and south to Guatemala.

FAMILY—HIRUNDINIDÆ.

PURPLE MARTIN (*Progne subis*).—This bird is one of the handsomest of the family, and is one of the most familiar. It affects the closest affinity with human habitations; building in boxes placed for it in the trees of the garden, or on the eaves of the house. It exhibits a fondness for returning, year after year, to the same spot where it has built its nest. It is a general inhabitant of the United States; extending its range as far north as Hudson's Bay. It is also found in South America as far as Chili, and is probably to be seen even farther south. A species, named P. subis, var. cryptoleuca, is found in Cuba.

BARN SWALLOW (*Hirundo horreorum*).—This familiar bird is the H. americana of Wilson, and the H. rufa of Bonaparte. "We welcome the first appearance of the Swallows with delight, as the faithful harbingers and companions of flowery spring and ruddy summer; and when, after a long, frost-bound and boisterous winter, we hear it announced that 'the swallows are come,' what a train of charming ideas are associated with the simple tidings!"—*Wilson.* The nest of this species is so often built in barns and outhouses, it has from that circumstance derived its name.

CLIFF SWALLOW (*Hirundo lunifrons*).—This is the H. respublicana of Audubon. Habitat, North America, from the Atlantic to the Pacific.

WHITE-BELLIED SWALLOW (*Hirundo bicolor*).—This species is common in the United States; building sometimes in the boxes put up for the Purple Martin, and in hollow trees. They are found as far north as Maine. Other species are: H. thalassina (Violet-green Swallow), from the Rocky Mountains to the Pacific; Cotyle riparia (Bank Swallow), the smallest of American Swallows, and C. serripennis (Rough-winged); habitat, from the Atlantic to the Pacific.

FAMILY—VIREONIDÆ.

FLORIDA GREENLET (*Vireosylvia calidris*).—This bird is known otherwise as WHIP-TOM-KELLY, its notes resembling that combination. It has been captured in Charlotte's Harbor, Florida, but is native in Cuba and the Bahamas. The form here alluded to is the variety barbatulus of Baird.

RED-EYED GREENLET (*V. olivaceus*).—This is common to the whole eastern section of North America, and south to Panama. It is seen and heard in the open squares of our larger cities, where its voice is "loud, musical, simple and pleasing."

YELLOW-GREEN VIREO (*V. flavoviridis*).—A southern species, ranging from the northern border of Mexico to the isthmus Panama. Little is known of its habits.

PHILADELPHIA GREENLET (*V. philadelphicus*).—Common in the Eastern States, and south as far as Guatemala.

WARBLING GREENLET (*V. gilvus*).—Sometimes called WARBLING FLY-CATCHER (Muscicapa melodia). Its range is from Eastern North America to Fort Simpson. A variety, swainsoni, is called the WESTERN WARBLING GREENLET, and is confined to the Pacific slope, west of the Rocky Mountains.

BLUE-HEADED VIREO (*Lanivireo solitarius*).—Muscicapa solitaria, SOLITARY FLY-CATCHER of Wilson. Its range is from the Atlantic to the Pacific, and south to Guatemala. Rare in Cuba. Prof. Baird gives an interesting account of its nest found in Lynn, Mass., communicated by Mr. Welch.

CASSIN'S VIREO (*L. solitarius, variety cassini*).—This variety was discovered by Mr. Ridgway, in Nevada. Another variety, plumbeus, is found in same region, and south as far as Mexico.

YELLOW-THROATED VIREO (*L. flavifrons*).—This bird is rather common in New England, and is regarded as a very sweet singer. Early authors credit it with a fondness for the forests, while the authors of *North American Birds* assert that no species of Vireo is more frequently seen in the vicinity of dwellings.

BLACK-CAPPED VIREO (*Vireo atricapillus*) is a Mexican species, and is found on the southern border of Western Texas.

WHITE-EYED VIREO (*V. noveboracensis*).—This is one of the most widely distributed and most common species of vireo in all parts of the United States, east of the Rocky Mountains. It is usually seen in wild, swampy grounds, near the edges of woods, among the smilax and other vines. Its white iris renders it a striking object. The Cow-bird often selects this bird's nest as a depository for its eggs.

HUTTON'S VIREO (*V. huttoni*).—A western form, found in California and Western Mexico.

BELL'S VIREO (*V. belli*).—Named in honor of John G. Bell, the taxidermist. It was first found by Audubon on the Yellowstone River. It seems to be confined to the middle country, between Missouri River and the Rocky Mountains.

LEAST VIREO (*V. pusillus*).—Found on the Pacific Coast, in California, and as far as Cape St. Lucas.

ARIZONA VIREO (*V. vicinior*).—But little is known of this bird, which is said to resemble a small specimen of V. plumbeus. Dr. Cones discovered it in Arizona, in 1866, and has described it in *Proc. Acad. Nat. Sci., Phila.*, of that year.

FAMILY—AMPELIDÆ.

NORTHERN WAXWING (*Ampelis garrulus*).—Called, also, BOHEMIAN CHATTERER. The range of this

familiar bird is very extended, reaching over the northern parts of Europe, Asia and America. In America it has not been seen on the Pacific slope. A most interesting account of this bird will be found in *North American Birds*, by Baird, Brewer and Ridgway.

CEDAR-BIRD (*Ampelis cedrorum*).—This is a common bird in New England, and is found in all parts of North America. It is unpopular on account of its robberies of cherry-trees. It is therefore less numerous, and less regular in its visitations. The common name, CHERRY-BIRD, is used in many parts of the north.

SHINING-CRESTED FLY-CATCHER (*Phœnopepla nitens*).—The "mountainous regions of the southern portions of Western and Middle Provinces of the United States, and south to Orizaba, Cape St. Lucas and the plateau of Mexico" are placed as the localities frequented by this species. It is one only of the genus.

TOWNSEND'S SOLITAIRE (*Myiadestes townsendi*).—This is a western bird, and one that has received attention from nearly every explorer and scientific traveler of the plains. Dr. Newberry found it very abundant in Des Chutes Basin, where he was attracted by its new and pleasant song, which he describes as "full, clear and melodious, like that of the true Mimus."

FAMILY—LANIIDÆ.

GREAT NORTHERN SHRIKE (*Collyrio borealis*).—Named Butcher-bird in many parts of the Northern States. It is met with in winter at the north, but breeds in most northern regions. Its food consists of mice, small birds, insects, etc., its sharp, hooked bill being almost as effective as that of the Hawks. Its feet, too, are quite powerful, the claws being recurved and of considerable strength. A singular habit is attributed to this bird by all who have observed and written concerning him. He captures at times more prey than he can easily dispose of, and, instead of hoarding it, as in the case of the Magpie and others, he impales his victims on some thorn, bush or briar. Grasshoppers and even small birds are found thus placed. The courage, dash and impetuosity of this bird is beyond that of any other species, not excepting any of the rapacious tribe. He is better known in our large towns as an occasional bandit. Some pet Canary has been placed in a sunny exposure within the veranda; the Butcher-bird has ventured in from the neighboring wood, gets sight of the yellow songster, and darts, with the celerity of an arrow, at the cage; frequently killing the bird by the force of the shock, and, in some instances, sustaining serious injury himself. This species is ten inches in length, and thirteen in extent of wing. A curious instance is related of his habit of impalement by Mr. Bell who, while traveling in Russia, had one kept confined in a room. A sharpened stick was fastened in the wall, and when small birds were let loose within, the Butcher-bird would instantly capture them, and, by aid of bill and claws, would draw them upon the sharpened stick; a number of victims being served in this manner.

LOGGERHEAD SHRIKE (*Collyrio ludovicianus*).—This is Lanius carolinensis of Wilson. It is somewhat smaller than the preceding, and much darker on the back and upper parts. Habitat, Southern States. A variety, robustus, called the WHITE-WINGED SHRIKE, is known to the Pacific Coast.

WHITE-RUMPED SHRIKE (*Collyrio excubitoroides*).—A species found in Missouri and on the Pacific slope, resembling the Loggerhead Shrike. This is regarded as a variety only of the latter.

FAMILY—CÆREBIDÆ.

BAHAMA CREEPER (*Certhiola bahamensis*).—This is the only species in North America which belongs to the genus. It is abundant in the Bahamas, and is occasionally found in the Florida Keys.

FAMILY—TANAGRIDÆ.

THE SCARLET TANAGER (*Pyranga rubra*).—This is one of the few brilliantly-colored birds that are familiar to the open fields of the New England States. The wings and tail being an intense black, and the remainder of the body a flaming scarlet, renders the bird a most conspicuous object; and, though rather solitary, or at least not gregarious to any extent, it is, through its wonderfully rich plumage, pretty generally known. "Among the thick foliage of the tallest trees, his simple and almost monotonous notes, *Chip, churr!* repeated at short intervals, in a pensive tone, may occasionally be heard, which appear to proceed from a considerable distance, though the bird be immediately above you—a faculty bestowed on him by the beneficent Author of Nature, no doubt for his protection, to compensate, in a degree, for the danger to which his glowing color would often expose him. Among all the birds that inhabit our woods, there is none that strikes the eye of a stranger, or even a native, with so much brilliancy as this."—*Wilson.* The Scarlet Tanager breeds in all the New England States. Samuels says: "Its song is almost exactly like that of the Robin, often broken with a pensive call-note, *Chip, churr!*" It thrives well in confinement.

SUMMER RED-BIRD (*Pyranga æstiva*).—This brilliantly-colored bird is seen mostly in the South Atlantic and Gulf States. Its plumage is entirely of a rich vermilion color. Wilson says: "In Pennsylvania they are rare, having myself passed a whole summer without seeing one of them; while, in New Jersey, even within a half a mile of the shore opposite the city of Philadelphia, they may generally be found during the season. The note of the male is a strong and sonorous whistle, resembling a loose trill or shake on the notes of the fife, frequently repeated." Du Pratz, in his *History of Louisiana*, has related some particulars of this bird, which have been repeated by almost every subsequent writer on the subject, viz.: that it "inhabits the woods on the Mississippi, and collects against winter a vast magazine of maize, which it carefully conceals with dry leaves, leaving only a small hole for entrance; and is

so jealous of it as never to quit its neighborhood, except for drink." Wilson doubts the truth of this assertion, and gives several reasons why the bird is not likely to adopt such measures. One, particularly, is that the climate being moderate, there seems no occasion for hoarding grains, especially as fruit and berries are numerous at all seasons where the bird is found. In the Rocky Mountains of New Mexico is found the Rocky Mountain Tanager (P. hepatica), less brilliant than the former, but considerably larger. The Louisiana Tanager (P. ludoviciana) is a southern and western species. A variety, cooperi, is known to the Southern and Western States.

FAMILY—FRINGILLIDÆ.

EVENING GROSBEAK (*Hesperiphona vespertina*).—Described by Audubon as Fringilla vespertina. Inhabits the Pacific Coast to the Rocky Mountains, and Northern America east to Lake Superior.

PINE GROSBEAK (*Pinicola enucleator*)—Plate 14, fig. 47.—Pyrrhula enucleator of Audubon. This species is found in Arctic America, and, in severe winters, in the United States. A genus, Pyrrhula, with one species, cassini, has been found in Alaska.

PURPLE FINCH (*Carpodacus purpureus*).—Fringilla purpurea of Audubon and Wilson. "This bird," says Wilson, "comes to us in large flocks from the north, in September and October; great numbers remaining with us in Pennsylvania during the whole winter, feeding on the seeds of the poplar, button-wood, juniper, cedar, and on those of many rank weeds that flourish in rich bottoms and along the margin of creeks. When the season is very severe, they proceed to the south, as far at least as Georgia, returning north early in April." A species, C. californicus, found on the Pacific Coast of the United States, is described by Baird as "similar to purpureus; purple of the head and rump much darker." Another species, from the Rocky Mountains and valley of the Colorado, is Cassin's Purple Finch (C. cassini). The latter is the largest of the American Purple Finches.

BURION; HOUSE FINCH (*Carpodacus frontalis*).—Described by Audubon as "Fringilla frontalis. Rocky Mountains to Pacific." This species is quite remarkable for the great variation in the shade of red in the different regions of the body. C. hæmorrhous (Mexican Finch) is found in New Mexico.

YELLOW-BIRD (*C. tristis*).—This pretty bird is one of the most familiar summer visitors in the Northern States, where, in the southern districts, it remains through the year. "The song of the Yellow-bird," says Wilson, "resembles that of the Goldfinch of Britain; but is in general so weak as to appear to proceed from a considerable distance, when perhaps the bird is perched on the tree over your head. During the latter part of summer they are almost constant visitants in our gardens, in search of seeds, which they dislodge from the husk with great address, while hanging frequently head downwards, in the manner of the Titmouse. From these circumstances, as well as from their color, they are very generally known, and pass by various names, expressive of their food, etc., such as Thistle-bird, Lettuce-bird, Salad-bird, etc."

ARKANSAS FINCH (*C. psaltria*).—"This Goldfinch is more like the C. tristis than any other of our species. Habitat, Southern Rocky Mountains, to the coast of California."—*Baird.*

BLACK GOLDFINCH; MEXICAN GOLDFINCH (*C. mexicana*).—Found on the Mexican side of the valley of the Rio Grande southward, and at the copper mines of the Gila.

PINE GOLDFINCH (*C. pinus*).—This bird is a winter visitor in New England. In severe weather they congregate among the pine-trees of the forests, to feed on the seeds of those trees. Its habits and notes are much like those of the Goldfinch.

RED CROSSBILL (*Curvirostra americana*)—Plate 14, fig. 48; and Fig. 118, vol. i, p. 365.—This is one of the most remarkable of our American birds, having the bill curved in such a manner as to give one the impression that it is a deformity. The two mandibles cross each other, and the dexterity with which they open the pine cones and extract the seeds shows plainly that this is a wise adaptation of means to end. It is a winter visitor to New England, and, according to Baird, resident in Pennsylvania, among the mountains. According to Mr. Allen and Prof. Verrill, it sometimes breeds as far south as Massachusetts and Maine. It inhabits almost all our pine forests situated north of 40°, from the beginning of September to the middle of April.

WHITE-WINGED CROSSBILL (*C. leucoptera*).—This species is less common than the preceding in its winter visits, though it frequents the same places and at the same seasons. It has all the general characteristics of that bird. A species described by Strickland as Loxia mexicana, is now regarded as a variety of the Curvirostra.

LESSER RED-POLL (*Ægiothus linarius*).—This is another common winter visitor in the Northern States. It congregates in large flocks, and is seen in the pasture-lands and fields, feeding on the seeds of grasses and on weeds. It has the habits of the Goldfinch and Pinefinch, and utters a similar note.

MEALY RED-POLL (*A. canescens*).—This is a very rare winter visitor in New England, being more common farther north. According to Prof. Verrill, it is rarely found in Maine. It differs from the preceding in its larger size and generally hoary appearance, and the pure white or rosy rump, never with dusky streaks, as in the female and young of A. linaria.

GRAY-CROWNED FINCH (*Leucosticte tephrocotis*).—Found in the Northern Rocky Mountains, and in the vicinity of Salt Lake City in winter. Two other species are recorded as belonging to the north-west coast of North America, viz.: Gray-necked Finch (L. griseinucha). The Gray-neck is similar to the Gray-crowned, but duller, and beneath more tinged with rosy; its cheeks and neck above distinctly gray.

SNOW BUNTING (*Plectrophanes nivalis*).—This is common to both continents. Other species are: Lapland Long-spur, Smith's Bunting and Chestnut-colored Bunting. Very similar to the last-named species is the P. melanomus, found on the eastern

slope of the Rocky Mountains. The P. maccownii of Lawrence is also found there.

THE HOUSE SPARROW (*Pyrgita domestica*).—This European species is now domesticated in our parks.

BAIRD'S BUNTING (*Ceutronyx bairdii*)—is somewhat similar in general appearance to the Savannah Sparrow (Passericulus savanna). It resembles in color the Smith's Bunting, and is found at the mouth of the Yellowstone River.

SAVANNAH SPARROW (*Passericulus savanna*).—In the eastern part of Massachusetts this bird is quite common in the summer months. In the interior of Maine it is also common, though generally it is found on the Atlantic sea-board, where it feeds on the insects and mollusks of the refuse sea-weeds. The P. sandwichensis is very much like the latter, and is only distinguished by its greater size and western locality. Habitat, north-western coast. On the coast of California, and in Russian America, is found a species, called the Spotted Sparrow (P. anthinus). This is the smallest of the group, and is distinguished by its numerous spots on the under parts. A species similar to the Savannah Sparrow, but smaller, is the Lark Sparrow (P. alaudinus). Habitat, coast of California, Texas and Mexico. Another species, found in California, is the Beaked Sparrow (P. rostratus).

GRASS FINCH; BAY-WINGED BUNTING (*Poocætes gramineus*).—"The manners of this bird bear great affinity to those of the Common Bunting of Britain. It delights in frequenting grass and clover fields; perches on the tops of fences, singing, from the middle of April to the beginning of July, with a clear and pleasant note, in which particular it far excels its European relation. It is partially a bird of passage here, some leaving us, and others remaining with us during the winter. They frequent the middle of the fields more than the thickets or hedges, and run along the ground like a Lark. They are timid birds, and rarely approach the farm-house."—*Wilson.*

YELLOW-WINGED BUNTING (*Caturniculus passerinus*).—This bird is irregularly distributed. In Massachusetts it is rare on the sea coast, but in the western part is an abundant summer visitor. It is rarely seen north of this State. Along the Atlantic border, south of Washington and westward to the Platte, is found a species, called the Henslow Bunting (C. henslowi). Near the mouth of the Yellowstone River occurs the C. lecontei, described originally by Audubon.

SHARP-TAILED FINCH (*Ammodromus caudacutus*).—"Massachusetts seems to be the northern limit of this species. In this State, and those south, it is not uncommon, but is confined to the districts in the neighborhood of the coast, and is never found more than a mile or two from those localities in the breeding season."—*Samuels.* Wilson says: "It courses along the margin, and among the holes and interstices of the weeds and sea-wrack, with a rapidity equaled only by the nimblest of our Sandpipers, and very much in their manner." This species derives its whole subsistence from the sea. Their stomachs are always filled with fragments of shrimps, minute shell-fish and the like.

THE SEASIDE BUNTING (*A. maritimus*) has habits very similar to the latter. A species found in California has been named A. samuelis.

LARK SPARROW (*Chondestes grammaca*).—This is found on the prairies of Illinois, westward to the Pacific Coast, and southward to Mexico.

IPSWICH SPARROW (*P. princeps*).—This is a new bird, discovered by Mr. Maynard, of Ipswich, Mass., in 1868. Several others were taken since, but the species has not been seen elsewhere. Nothing is known of its habits. It was first described as Ceutronyx bairdii, but it is now regarded as above.

WHITE-CROWNED SPARROW (*Zonotrichia leucophrys*)—formerly called the WHITE-CROWNED BUNTING—is one of the rarest of its tribe in the United States. It resembles the White-throated Sparrow considerably. In the Rocky Mountains, and westward to the Pacific, the Gambel's Finch (Z. gambelii) is found. It closely resembles the preceding. The Golden-crowned Sparrow (Z. coronata) is seen on the Pacific Coast, from Russian America to California. Harris's Finch (Z. querula) inhabits the country along the Missouri River, above Fort Leavenworth. The White-throated Sparrow (Z. albicollis) is a beautiful species. It breeds abundantly in the northern districts of New England, and is found throughout the United States to the Missouri River.

MEXICAN JUNCO (*Junco cinereus*).—This is an allied form, found in Mexico. Another species, the Oregon Snow-bird, described by Audubon as Fringilla oregona, now known as Junco oregonus, is found along the eastern side of the Rocky Mountains, and westward to the Pacific. The Red-backed Snow-bird (J. caniceps) is from New Mexico.

SNOW-BIRD (*Junco hyemalis*).—Wilson says of this interesting bird: "This well-known species, small and insignificant as it may appear, is by far the most numerous, as well as the most extensively disseminated of all the feathered tribes that visit us from the frozen regions of the north: their migrations extending from the Arctic circle, and probably beyond it, to the shores of the Gulf of Mexico, spreading over the whole breadth of the United States.

BLACK-THROATED SPARROW (*Poospiza belineata*).—This is a comparatively new species, found in the Middle Province of the United States.

BELL'S FINCH (*Poospiza belli*).—"This remarkable sparrow needs comparison with no other North American species for its identification."—*Baird.* It is named in honor of Mr. John Bell, the taxidermist of New York. Habitat, Southern California and the valley of Gila and Colorado. Ridgway has added to our Fauna a variety of this species, which he names nevadensis, and affixes the trivial name, Artemisia Sparrow.

TREE SPARROW (*Spizella monticola*).—This is a winter resident in New England. Wilson says: "He takes up his winter quarters in Pennsylvania and most of the Northern States, as well as several of the Southern ones."

FIELD SPARROW (*S. pusilla*).—This is the smallest of our native Sparrows. "It is more frequently

found in the middle of fields and orchards than any of the other species which usually lurk along hedge-rows. It has no song, but a kind of chirruping, not much different from the chirpings of a cricket."—*Wilson*. Habitat, Eastern North America to the Missouri River.

CHIPPING SPARROW (*S. socialis*).—This is one of the most familiar birds in the Northern States. It is an early visitor, sometimes appearing by the middle of March. Its nest is so universally lined with horse-hairs, it has come to be called, in some regions, HAIR-BIRD, or HAIR SPARROW. It is this species that is so often burdened with the eggs of the Cow-bird; the latter lays them in the nest of the Sparrow, where they are hatched, and where the young Cow-birds find a home and sustenance in company with the legitimate brood. The CLAY-COLORED BUNTING (S. pallida) is found on the upper Missouri River. A species much resembling the latter, and found from the Rocky Mountains to the Pacific, is the Brewer's Sparrow (S. breweri). It is now regarded as a variety only. A Mexican species is S. atragularis, the Black-chinned Sparrow. A variety of S. socialis, arizonæ, is found in the west.

SONG SPARROW (*Melospiza melodia*).—Of all our Sparrows, this is the most numerous, the most generally diffused over the United States, and by far the earliest, sweetest and most lasting songster. It may be said to be partially migratory, many passing to the South in the month of November, and many of them still remaining with us, in low, close, sheltered meadows and swamps, during the whole of winter. It is the first singing-bird in spring, taking precedence even of the Pewee and Blue-bird. The Song Sparrow builds his nest usually on the ground, but occasionally on a bush or low tree; it is lined, like that of the Chipping Sparrow, with horse-hair. Quite often it raises three broods in a season. A variety, found in California, has been named by Prof. Baird M. hermani. Another, from the same region, is the M. gouldi, *Baird*. The Rusty Song Sparrow (M. rufina, *Baird*) is from the Pacific Coast northward to Russian America. A species resembling the Song Sparrow, but larger, is the Mountain Song Sparrow (M. fallax, *Baird*). It is from the Rocky Mountains. Lincoln's Finch (M. lincolni), described by Audubon as Fringilla, is distributed through the States, from the Atlantic to the Pacific, and south to Mexico.

SWAMP SPARROW (*Melospiza palustris*).—This is not so common in New England as the Song and Chipping Sparrows, but breeds in all the Northern States. They build their nests generally in a bunch of grass, in swampy places. Their food is principally grass seeds, wild oats and insects. They have no song, but utter a single *chirp*, or *cheep*.

BACHMAN'S SPARROW (*Peucæa æstivalis*).—This is the Fringilla bachmani of Audubon. It is a southern bird, found in Georgia and the Gulf States. Ridgway has added an Arizona variety.

CASSIN'S SPARROW (*P. cassini*).—Prof. Baird says of this species: "It has a considerable resemblance to P. æstivalis, but differs in some appreciable points." Length, six inches. Habitat, San Antonio, Texas, to Los Nogales, Sonora.

BROWN-HEADED SPARROW (*P. ruficeps*).—Originally described by Cassin as Ammodromus ruficeps. Its length is five and a half inches. Habitat, coast of California.

TEXAS SPARROW (*Embernagra rufivirgata*) is described by Mr. Geo. N. Lawrence, in *Ann. N. Y. Lyceum Nat. Hist.* Its length is five and a half inches. Habitat, valley of the Rio Grande, and probably of Gila, southward; Mazatlan, Mexico.

FOX-COLORED SPARROW (*Passerella iliaca*).—Fringilla rufa of Wilson. "This plump and pretty species arrives in Pennsylvania from the north about the 20th of October, frequents low, sheltered thickets, associates in little flocks of ten or twelve, and is almost continually scraping the ground and rustling among the fallen leaves."—*Wilson*. This bird is very abundant in New England in the spring and autumn, arriving early in March, and going still farther north in April. In the autumn it arrives from the north, and departs for its southern winter home late in November.

TOWNSEND'S SPARROW (*P. townsendi*).—This is the Fringilla townsendi of Audubon. "This species differs a good deal from the iliaca (last named). The claws are much larger and stouter, the wing a good deal shorter and more rounded. The differences in color are very appreciable, the tints being dark olivaceous-brown, instead of red, and perfectly uniform above, not spotted; the under parts much more thickly spotted."—*Baird*. Habitat, coast of United States, as far south as Sacramento.

SLATE-COLORED SPARROW (*P. schistacea*).—This new species is described by Prof. Baird as follows: "It is readily distinguished from P. iliaca by the slate back and spots on its breast, without any streaks above. The bill is much stouter, and the claws longer. From townsendi it differs in having the head, back, sides and spots beneath, slate colored, instead of dark reddish-brown. The spotting beneath is much more sparse, the spots smaller, more triangular and confined to the terminal portion of the feathers, instead of frequently involving the entire outer edge. The bill is stouter. The wings and tail are the same in both species." It is found at the head waters of the Platte, and at Fort Tejon, California. It is now regarded as a variety only of the latter.

THICK-BILLED FINCH (*P. megarhynchus*) is another new variety of P. townsendi, from the west.

LARK BUNTING (*Calamospiza bicolor*).—This species, sometimes called the WHITE-WINGED BLACK-BIRD, is the Corydalina of Audubon. "Habitat, high central plains to the Rocky Mountains, southwesterly to the valley of Mimbres and Sonora."

BLACK-THROATED BUNTING (*Euspiza americana*).—This is an extremely rare bird in New England. Massachusetts seems to be its most northern limit. "In their shape and manners they very much resemble the Yellow Hammers of Britain (E. citrinella). Like them they are fond of mounting to the top of some half-grown tree, and there chirruping for half an hour at a time."—*Wilson*.

TOWNSEND'S BUNTING (*Euspiza townsendi*).—Of this bird Prof. Baird says: "This curious bird has long been a puzzle to ornithologists in the uncertainty whether it is only a variety of Euspiza americana, or a distinct species. Thus far but one specimen is known, the one before me, kindly lent to the Smithsonian Institution by Dr. Micherer, and previously figured and described by Mr. Audubon."

ROSE-BREASTED GROSBEAK (*Hedymeles ludovicianus*).—This elegant bird is found as a summer visitor in all parts of New England, though sparsely, and in other sections east of the Missouri plains. Wilson gives an account of one kept in a cage by a gentleman in Connecticut, which frequently sang at night, and uttered notes of extreme sweetness and clearness.

BLACK-HEADED GROSBEAK (*Hedymeles melanocephalus*).—This is the Fringilla of Audubon, and Coccoborus of Audubon's Synopsis. It is found in the high central plains, from the Yellowstone to the Pacific.

BLUE GROSBEAK (*Guiraca cærulea*).—"This solitary and retired species inhabits the warmer parts of America, from Guiana, and probably farther south, to Virginia. Mr. Bartram also saw it during a summer's residence near Lancaster, Pa. In the United States it is, however, a rare species, and, having but few notes, is more rarely observed. They are timid birds, watchful, silent and active. They feed on seeds and the kernels of several kinds of berries."—*Wilson.*

VARIED BUNTING (*Cyanospiza versicolor*).—This beautiful Spiza is sufficiently distinct from the other North American species not to require any comparison between adult males. Its habitat is Northeastern Mexico to the Rio Grande.

LAZULI FINCH (*Cyanospiza amœna*).—This is about the size of the C. cyanea, the bill being exactly similar. Habitat, high central plains to the Pacific.

INDIGO-BIRD (*Cyanospiza cyanea*).—In the more populous regions of New England the Indigo-bird is a common summer visitor. Its rich plumage and its pleasant song make it a favorite in the country-side. Nuttall says: "Though naturally shy, active and suspicious, they still, at the interesting period of procreation, resort chiefly to the precincts of habitations, around which they are far more common than in the solitary woods, seeking their borders or the thickets by the sides of the roads; but their favorite resort is the garden."

PAINTED BUNTING (*Cyanospiza ciris*).—This beautiful little bird is a favorite in Louisiana, where it is called by the French inhabitants, Le Pape. It also is known there as the Nonpareil. In the low countries, especially in the rice plantations, he is particularly at home. His notes are similar to those of the Indigo-bird, but have not the strength and energy of the latter. Wilson says that he found him the most commonly domesticated bird in New Orleans, and adds: "Were the same attention bestowed on these birds as on the Canary, I have no doubt but they would breed with equal facility, and become equally numerous and familiar, while the richness of their plumage might compensate for their inferiority of song. These birds arrive in Louisiana from the south about the middle of April, and begin to build early in May. Their food consists of rice, insects, and various kinds of seeds that grow luxuriantly in their native haunts. Early in October they retire to more southern climes, being extremely susceptible to cold."

LITTLE SEED-EATER (*Spermophila moreleti*) is found on the Rio Grande of Texas, and in Honduras. It is the smallest of American passerine birds. The Black-faced Finch (Phonipara zena) is a West Indian species, found in Florida.

TEXAS CARDINAL (*Pyrrhuloxia sinuata*) is found in the valley of the Rio Grande.

RED-BIRD; CARDINAL (*Cardinalis virginianus*).—Of this bird Wilson says: "This is one of our most common cage-birds, and is very generally known, not only in America, but even in Europe. In Pennsylvania and the Northern States it is rather a scarce species, but through the whole lower parts of the Southern States, in the neighborhood of settlements, it is common." A variety, igneus, is found in western territories. Wilson asserts that the female of the species "often sings nearly as well as the male."

TOWHEE; GROUND ROBIN (*Pipilo erythropthalmus*) is a very common species in the Southern New England States, and extends as far west as the Missouri River. Its common name, Towhee, is derived from its peculiar note. In Virginia he is called the Bullfinch, and in many places Chewink and Swamp Robin. Its presence in the woods is known very readily, even if its notes are not heard, as it is usually busy in scratching away the leaves in search of food; in this it makes as much bustle and noise as an old hen might in the same occupation. Its food consists of worms, insects and seeds, which it finds under the debris of the forest. About the middle of October it migrates to the south. A variety, alleni, is found in Florida.

OREGON GROUND ROBIN (*P. oregonus*).—This species, described by Mr. Bell, is found on the coast of Oregon and Washington Territories. "It is readily distinguished from the former by the white on the scapulars and wing coverts. Its relationships to arcticus are much closer."—*Baird.*

ARCTIC GROUND ROBIN (*P. arcticus*).—"This species is similar in form to the P. erythropthalmus, which, however, is readily distinguished by the entire absence of white on the scapulars and wing coverts. The amount of white on the tail decreases much less rapidly. The differences between it and P. oregonus will be found detailed under the head of the latter species."—*Baird.* Habitat, high central plains of Upper Missouri, Yellowstone and Platte.

SPURRED TOWHEE (*P. megalonyx*).—"This form, if not a distinct species, constitutes so strongly marked a variety as to be worthy of particular description. The general appearance is that of P. arcticus, which it resembles in the amount of white spotting on its wings."—*Baird.* Habitat, southern coast of California, and across through the valleys of Gila and Rio Grande.

ABERT'S TOWHEE (*P. aberti*).—"This plainly-colored bird is among the largest of the North American species." Habitat, at the base of the Rocky Mountains in New Mexico, valley of Gila and Colorado.

BROWN TOWHEE (*P. fuscus*).—"This species is much darker than P. aberti, and lacks the black on chin and sides of head. The chin and throat are abruptly different from the breast; the light patch margined with black spots." It inhabits the coast region of California.

CANON FINCH (*P. mesoleucus*) is similar in general appearance to the P. fuscus, and is found in the valley of the upper Rio Grande, and across to Gila River, east to Santa Caterina, New Leon.

GREEN-TAILED BUNTING (*P. chlorurus*) is the Fringilla chlorura of Townsend. Habitat, valley of the Rio Grande and Gila, Rocky Mountains north to the South Pass, south to Mexico.

FAMILY—ALAUDIDÆ.

THE SKYLARK (*Alauda arvensis*)—Plate 13, fig. 46.—This is the European species, which has been introduced into our country. It is recorded by authors as "accidental in Greenland and Bermuda, and in the Aleutian Islands."

THE SHORE LARK (*Eremophila alpestris*).—This species is the same on both hemispheres, although our bird is regarded as a variety. It breeds in the Arctic regions. A variety, which is found to belong to Middle America, is called E. chrysoleuca.

FAMILY—ICTERIDÆ.

BOBOLINK; REED-BIRD; RICE-BIRD (*Dolichonyx oryzivorus*)—Plate IV, fig. iii—is one of the most common of our summer visitors, reaching the north about the middle of May. To the rice-planters of the Southern States this bird is not particularly welcome, for the immense flocks which at times come upon the rice fields make incalculable mischief and loss for them. By the term Bobolink this bird is better known in the Northern States. Audubon says of it: "In Louisiana they arrive there, in small flocks of males and females, about the middle of March or beginning of April. Their song in spring is extremely interesting, and, emitted with a volubility bordering on the burlesque, is heard from a whole party at the same time; and it becomes amusing to hear thirty or forty of them beginning one after another, as if ordered to follow in quick succession, after the first notes are given by a leader, and producing such a medley as it is impossible to describe, although it is extremely pleasant to hear. While you are listening, the whole flock simultaneously ceases, which appears equally extraordinary. This curious exhibition takes place every time the flock has alighted on a tree."

Wilson says of him: "The song of the male, while the female is sitting, is singular and very agreeable. Mounting and hovering on wing, at a small height over the field, he chants out such a jingling medley of short, variable notes, uttered with such seeming confusion and rapidity, and continued for a considerable time, that it appears as if half a dozen birds of different kinds were all singing together. Some idea may be formed of this song by striking the high keys of a pianoforte at random, singly and quickly, making as many sudden contrasts of high and low notes as possible. Many of the tones are, in themselves, charming, but they succeed each other so rapidly that the ear can hardly separate them."

COW-BIRD; COW BLACKBIRD (*Molothrus pecoris*)—Plate VI, fig. ix.—As a summer visitor this bird is very common in the Northern States. It derives its trivial name from the fact that it seems fond of the society of cattle. They congregate in great numbers in the pastures where the cattle feed, probably for seeds, worms, etc., found in the excrement. A most unaccountable habit of this bird is that of laying its eggs in the nests of other and smaller birds. Frequently the eggs are hatched and the young cared for by the foster mother until they are able to leave the nest. Occasionally a nest is found where the unwelcome egg of the Cow-bird (which, in some instances, half fills that of the little Warbler) is excluded or covered by the material of a new nest built over and within the old one. The Yellow-throat and Red-eyed Fly-catcher are victims of this annoyance from the Cow-bird. When the egg of the latter is deposited before the rightful tenant has commenced laying, the nest is generally deserted. It is believed that this bird does not build a nest, but relies entirely on the good offices of other species. "From twelve to fourteen days is the usual time of incubation with our small birds; but, although I cannot exactly fix the precise period requisite for the egg of the Cow Bunting, I think I can say almost positively that it is a day or two less than the shortest of the above-mentioned species. In this singular circumstance, we see a striking provision; for did this egg require a day or two more, instead of so much less than those among which it has been dropped, the young it contained would in every instance most inevitably perish, and thus, in a few years, the whole species must become extinct. On the first appearance of the young Cow Bunting, the parent being frequently obliged to leave the nest to provide sustenance for the foundling, the business of incubation is thus necessarily interrupted; the disposition to continue it abates. Nature has now given a new direction to the zeal of the parent; and the remaining eggs, within a week or two at most, generally disappear. In some instances, indeed, they have been found on the ground near or below the nest, but this is rarely the case. I have never known more than one egg of the Cow Bunting in the same nest. The egg is somewhat larger than that of the Blue-bird, thickly sprinkled with grains of pale brown on a dirty white-brown. It is of a size proportionable to that of the bird."—*Wilson.* The Cow-bird is at all times gregarious and polygamous, never making and never exhibiting any signs of either conjugal or parental affection. It is distributed pretty generally throughout the United States, from the

Atlantic to the Pacific, though not found immediately on the Pacific Coast. In Maine it is considered rare.

RED-WINGED BLACKBIRD (*Agelaius phœniceus*).—Wilson, in treating of this bird, arraigns him firstly for trial as to the universally alleged reputation for theft, and proceeds in this wise: "In investigating the nature of these I shall endeavor to render strict historical justice, adhering to the honest injunctions of the poet—

"'Nothing extenuate,
Nor set down aught in malice.'

"Let the reader divest himself of prejudice, and we shall be at no loss to ascertain accurately his true character. They arrive in Pennsylvania late in March. Their general food at this season, as well as during the early part of summer, consists of grub-worms, caterpillars and various other larvæ, the silent but deadly enemies of all vegetation. For these vermin the Starlings search with great diligence in the ground, at the root of plants, in orchards and meadows, as well as among buds, leaves and blossoms; and, from their known voracity, the multitudes of those insects which they destroy must be immense." Wilson then estimates, approximately, the number of noxious insects that one bird of this species may destroy in a season, and demonstrates clearly that their services are far more important and beneficial than the value of all that portion of corn which a careful and active farmer permits himself to lose by it. This species is known by several different names, such as Swamp Blackbird, Marsh Blackbird, Corn-thief, Red-wing Starling, etc. The male is notably very much larger than the female, being two inches longer. It is common throughout the States, from the Atlantic to the Pacific.

RED-SHOULDERED BLACKBIRD (*A. gubernator*).—This is a western variety, confined to the Pacific Coast. "In certain states of plumage," says Prof. Baird, "I find it exceedingly difficult to distinguish satisfactorily this species from A. phœniceus. The females are scarcely to be distinguished from those of A. tricolor, except possibly by the more rounded tail, and stouter, shorter bill." During the summer this species is said to emit a variety of sweet and liquid notes, delivered from some tree near its favorite marsh. These are sometimes mingled with jingling and creaking sounds. Mr. Ridgway found them abundant in the marshy regions of California, but they were rarely met with east of the Sierra Nevada. A. tricolor is found in the Pacific Province of the United States.

YELLOW-HEADED BLACKBIRD (*Xanthocephalus icterocephalus*).—This species is found more frequently on the prairies, ranging from Texas to Illinois, and thence to the Pacific. Dr. Cooper states that the only song the male attempts consists of a few hoarse, chuckling notes and comical squeakings, uttered as if it was a great effort to make any sound at all. Mr. Ridgway found it very abundant in California. He thinks its notes harsher than those of any bird known to him. It walks upon the ground much in the same steady, graceful manner as the Cow-bird.

MEADOW LARK (*Sturnella magna*).—This is a common summer visitor in the Northern States. In the milder winters it remains in the north. The favorite haunts of this bird are the meadows and pastures. When they alight on trees or bushes, it is generally on the tops of the highest branches, whence they send forth a long, clear and somewhat melancholy note, that in sweetness and tenderness of expression is not surpassed by any of our numerous Warblers. They are regarded as next to the Bobwhite as a table delicacy, and are found at all seasons in the markets of the Middle States.

WESTERN LARK (*Sturnella neglecta*).—"This species," says Baird, "is so very closely related to the S. magna as to render it very difficult to distinguish them. The prevailing shade of color is, however, decidedly paler in the present, the light margins to the feathers being purer, the intervals of the dark markings being not reddish-brown so much as olivaceous, with a faint trace only of chestnut. A remarkable difference in their notes is considered as of importance in the consideration of the specific distinction." In the lately published work of Baird, Brewer and Ridgway, this species is entered as a variety. Its habitat is given as Western America, from high central plains to Pacific, east to Pembina, and perhaps to Wisconsin.

TROUPIAL (*Icterus vulgaris*).—This is a South American species, found occasionally on the southern coast of the United States. It is the largest of the Orioles found here. This species is common in the West Indies. Audubon describes it as a North American bird, having met with stragglers from the Antilles. It is common in all the northern countries of South America, where it associates in large flocks, and constructs a large and pensile nest. In confinement it becomes very easily tamed, and has a loud, clear and ringing whistle, and a great variety of call-notes, and single or brief utterances.

BLACK-HEADED ORIOLE (*Icterus melanocephalus*).—In the warm parts of Mexico this bird is known. It is similar to the I. auduboni, but without any white whatever on the wings. The head and neck all round, wing scapulars and tail, uniform pure black; rest of body, including beneath the wing and tibia, and the lesser wing coverts, orange-yellow, clouded with olivaceous-green on the back, less so on the rump; bill and legs plumbeous, the former whitish at base.

AUDUBON'S ORIOLE (*I. auduboni*).—Found in the valley of the Lower Rio Grande of Texas and southward. In this species there is no yellow below the black of the feathers of the head, the basal portion being plumbeous. The outline of the black on the upper neck is at the same distance from the bill all round, except on the throat, where it extends three quarters of an inch farther back, as a semi-circular patch on the upper part of the breast. There is a slight orange tinge on the breast; the sides under the wings and back more greenish. The tail feathers are entirely black to their bases, some of them tipped with whitish.

SCOTT'S ORIOLE (*I. parisorum*).—This is another southern species, not mentioned by Wilson or Audubon, but described by Bonaparte. It inhabits the valley of the Rio Grande and Guatemala. In Texas it is found on the Pecos.

ORCHARD ORIOLE (*I. spurius*).—In the southern portions of New England this bird is a summer visitor, but is rare in most other parts of that section. In the Middle States it is more common than the Baltimore Oriole. Unlike the Baltimore Oriole, it builds its nest *on* the branches, and not beneath them, in a pensile manner. Nuttall describes the Orchard Oriole as an exceedingly active, sprightly and restless bird; in the same instant almost he is on the ground after some fallen insect, fluttering amidst the foliage of the trees, prying and springing after his lurking prey, or flying and tuning his lively notes in a manner so hurried, rapid and seemingly confused, that the ear is scarce able to thread out the shrill and lively syllables of his agitated ditty. Between these hurried attempts he also gives others, which are distinct and agreeable, but still his tones are neither so full nor so mellow as those of the brilliant and gay Baltimore. According to Audubon, they sing with great liveliness in cages, being fed on rice and dry fruits, when fresh cannot be procured. Their ordinary diet is caterpillars and other insects, of which they destroy great quantities. Of the nest of this bird, Wood says: "It is truly a wonderful structure, woven into a bag or purse-like shape from long grasses, almost as if it had been fashioned in a loom, and so firmly constructed that it will withstand no small amount of rough treatment before it gives way. In one of these purse-like nests now lying before me, I find that the bird often employs two and sometimes three threads simultaneously, and that several of these double threads pass over the branch to which the nest is hung, and are then carried to the very bottom of the purse, so as to support the structure in the firmest possible manner. The entrance is from above, and near the mouth." Wilson says he had the curiosity to detach one of the fibres or stalks of grass which form the nest, and found it to measure thirteen inches in length, and, in that distance, was thirty-four times hooked through and returned, winding round and round the nest. Speaking of his services to the farmer, he says: "He visits us at a time when his services are of the greatest value, and, like a faithful guardian, takes up his station where the enemy is most to be expected: he ought to be held in respectful esteem, and protected by every considerate husbandman." Nor is the gayety of his song one of his least recommendations. Being an extremely active bird, he is on the ground, on the trees, flying and carolling in his hurried manner, in almost one and the same instant. His notes are shrill and lively, but uttered with such rapidity and seeming confusion that the ear is unable to follow them distinctly. Between these he has a single note, which is agreeable and interesting. Audubon says of him: "No sooner have they reached that portion of country in which they intend to remain during the time of raising their young, than the birds exhibit all the liveliness and vivacity belonging to their nature. The male is seen rising in the air from ten to twenty yards in a violent manner, jerking his tail and body, flapping his wings, and singing with remarkable impetuosity, as if under the influence of haste, and anxious to return to the tree from which he has departed. He accordingly descends, with the same motions of the body and tail, repeating his pleasing song as he alights. These gambols and warblings are performed frequently during the day, the intervals being employed in ascending and descending along the branches and twigs of different trees, in search of insects. In doing this they rise on their legs, seldom without jerking the tail, stretch the neck, seize the prey, and emit a single note, which is sweet and mellow, although in power much inferior to that of the Baltimore." The range of this species is from the Atlantic to the high central plains, and probably through Texas, south to Guatemala.

BALTIMORE ORIOLE (*I. baltimore*).—Plate IV, fig. iv.—This well-known and elegant bird is abundant in New England during the summer, and is distributed throughout the whole of North America, extending to Mexico, and south as far as Brazil. In New England it is known as the Golden Robin, and elsewhere as Fire-bird, Hang-nest, etc. "There is nothing more remarkable," says Nuttall, "in the whole instinct of our Golden Robin than the ingenuity displayed in the fabrication of its nest, which is, in fact, a pendulous cylindrical pouch of five to seven inches in depth, usually suspended from near the extremities of the high drooping branches of trees, such as the elm, the pear, etc. It is begun by firmly fastening natural strings of the flax of the silk weed or swamp hollyhock, or stout, artificial threads, around two or more forked twigs, corresponding to the intended width and depth of the nest. With the same materials, willow down, or any accidental ravellings, strings, thread, sewing-silk, thread or wool that may be lying near the house or around grafts of trees, they interweave and fabricate a sort of coarse cloth into the form intended, toward the bottom of which they place the real nest, made chiefly of lint, wiry grass, horse and cow hair; sometimes, in defect of hair, lining the interior with a mixture of slender strips of smooth vine-bark, and rarely with a few feathers, the whole being of a considerable thickness, and more or less attached to the external ponch. Over the top, the leaves, as they grow out, form a verdant and agreeable canopy, defending the young from the sun and rain. There is sometimes a considerable difference in the manufacture of these nests, as well as in the materials which enter into their composition. Both sexes seem to be equally adepts at this sort of labor, and I have seen the female alone perform the whole without any assistance, and the male also nearly complete this laborious task without the aid of his consort, who, however, in general, is the principal worker." "The song of the Baltimore-bird," says Wilson, "is a clear, mellow whistle, repeated at short intervals, as he gleans among the branches. There is in it a certain

wild plaintiveness and *naiveté* extremely interesting. It is not uttered with the rapidity of the Ferruginous Thrush and some other songsters, but with the pleasing tranquility of a careless plough-boy, whistling merrily for his own amusement. When alarmed by an approach to his nest, or any such circumstance, he makes a kind of rapid chirruping, very different from his usual note. This, however, is always succeeded by those mellow tones which seem so congenial to his nature." These birds do not receive their full plumage for several years. In their perfect livery few birds equal them in brilliancy. Who does not easily recall the fiery gleam which follows the entrance of the Golden Robin into his bower of green foliage, the colors of both plumage and foliage heightened by the contrast?

HOODED ORIOLE (*I. cucullatus*).—"In the valley of the lower Rio Grande, southward," says Prof. Baird, "this species is found." It is one of the North American birds described since the days of Audubon and Wilson. It was first introduced into our Fauna by Mr. Lawrence. Its length is seven and a half inches, the wing three and a quarter inches.

BULLOCK'S ORIOLE (*I. bullocki*).—This is one of the western species described by Audubon, but originally by Swainson as Xanthornus. It is found on the high central plains, thence to the Pacific, and southward into Mexico. The bill and tail are very much as in the Baltimore. "It is, however, a larger species, and is readily distinguished by the yellow of the front and sides of the head and neck, with a black line through the eye, instead of having the whole head and neck black; lesser wing coverts black, not yellow; a much broader white band on the wings, etc."—*Baird.*

RUSTY BLACKBIRD (*Solecophagus ferrugineus*).—This is a visitor in New England during the spring and fall migrations. In Virginia and southward they are very abundant during the winter months. Wilson saw great numbers of them in the woods near Petersburg, Va., and found them abundant in the rice plantations of South Carolina. They also extend westward. Samuels found them breeding in the valley of Magalloway River in Maine. "Their nests," he continues, "were built in low alders overhanging the water; they were constructed of first a layer of twigs and brier-stalks; on this was built the nest proper, which was composed of stalks and leaves of grass, which were mixed with mud and moulded into a firm, circular structure, and lined with fine leaves of grass and a few hair-like roots. The whole formed a large structure, easily seen at a distance of a few rods through the foliage. The eggs are of a bluish-white color, of oval form, and covered with fine scratches and spots of light brown. These markings are almost exactly similar to those on the egg of the Great-crested Fly-catcher; they appear as if done with a pen, which, as soon as it is pressed forcibly on the object, is suddenly withdrawn, making a mark wide at one end, and sharply pointed at the other. The habits of this species are less known than those of any of our Blackbirds. This is owing as much to its unsocial, retiring disposition as to the scarcity of its numbers. When it arrives in the spring, sometimes as early as the third week in March, it frequents the low, swampy thickets, where, in companies of three or four, it employs itself in searching for seeds of various aquatic grasses, insects, worms, and the small crustaceæ found in such localities."

BREWER'S BLACKBIRD (*S. cyanocephalus*), named after Dr. Brewer, the eminent ornithologist, is found on the high central plains, thence to the Pacific, and southward to Mexico. It was first described by Wagler in 1829 as Psarocolius, and is mentioned by Audubon as Quiscalus. It is considerably larger than the Rusty Blackbird. Its specific name is derived from its glossy purplish-violet head and neck.

CROW BLACKBIRD (*Quiscalus purpureus*), or PURPLE GRAKLE.—This is a common bird in New England in the summer season, arriving about the first week in April. It is a social species; and they are in the habit of remaining in flocks, breeding in numbers on the same tree. Audubon says of them: "The lofty, dead trees left standing in our newly cultivated fields, have many holes and cavities, some of which have been bored by woodpeckers, and others caused by insects and by decay. These are visited and examined in succession, until, a choice being made, and a few dry weeds and feathers collected, the female deposits her eggs, which are from four to six in number, blotched and streaked with brown and black." Such is their manner of building in Louisiana. In the Northern States their nests are differently constructed, and, as mentioned by Mr. Audubon, it is a singular circumstance that a comparatively short distance should so vary this formation. In the Northern States they construct their nests in a more perfect manner, building in the pine-trees a nest which resembles that of the Robin. It is much larger than the latter, and often there are a dozen or more arranged on the horizontal branches, and forming tier above tier, from the lowest to the highest limbs. Audubon asserts that he several times found them building in fissures of rocks. They rarely produce more than one brood in a season. Wilson says: "A few miles from the banks of the Roanoke I met with one of those prodigious armies of Grakles. They rose from the surrounding fields with a noise like thunder, and, descending on the length of road before me, covered it and the fences completely with black; and when they again rose, and, after a few evolutions, descended on the skirts of the high timbered woods, at that time destitute of leaves, they produced a most singular and striking effect: the whole trees for a considerable extent, from the top to the lowest branches, seemed as if hung in mourning, their notes and screamings the meanwhile resembling the distant sound of a great cataract, but in more musical cadence, swelling and dying away on the ear, according to the fluctuation of the breeze. In Kentucky and all along the Mississippi, from its junction with the Ohio to the Balize, I found numbers of these birds, so that the Purple Grakle may be considered a very general inhabitant of the territory of the United States."

Like the other species held in such dread by the farmer, this bird is equally capable of doing him a favor and a mischief. It is, however, generally believed that the general good offices in destroying the worms and grubs very far outweigh any occasional and special damage he may inflict. Wilson records a singular habit of this bird—that of forming an attachment to the Fish Hawk. The nest of the latter is of very large dimensions, often from three to four feet in breadth, and from three to four feet high, composed of large sticks or fagots, among the interstices of which sometimes three or four pairs of Crow Blackbirds will construct their nests, while the Hawk is sitting or hatching above. Here each pursues the duties of incubation and of rearing their young, living in the greatest harmony.

BRONZED GRAKLE (*Q. æneus*).—This is a variety of the latter, named by Mr. Ridgway in *Birds of North America*. They are migratory and gregarious. In Illinois they are resident throughout the year. In the vicinity of Calais, in Maine, they breed habitually.

FLORIDA GRAKLE (*Q. aglæus*).—This is the smallest of the genus within the limits of North America. It seems to be confined exclusively to the peninsula of Florida. It differs from the purpureus and the æneus, besides, in its much smaller size, in having a more slender and a more decurved bill. All the colors are darker, but softer than in the others. It is lately placed as a variety only of the purpureus.

BOAT-TAILED GRAKLE (*Q. major*), or JACKDAW. This is a large species, inhabiting the Southern Atlantic and Gulf coasts, and also the mouth of the Rio Grande, Texas. Specimens were found in Brownsville, Texas, associated with the macrourus, or Great-tailed Grakle. "The ceral region and space around the eye are quite bare of feathers."—*Baird.*

GREAT-TAILED GRAKLE (*Q. macrourus*).—This is recorded in the late work of Prof. Baird as a variety of the latter. It is three inches longer, being eighteen inches, with a wing seven and a half inches. "The graduation of the tail in this species is very great, the distances between the tips of the outer tail feather and the next being 1.30 inches, and decreasing successively with the rest. There is something quite peculiar in the softness and closeness of the feathers on the head, which stand almost erect, like the pile of velvet. Habitat, valley of the lower Rio Grande of Texas, southward."—*Baird.*

FAMILY—STURNIDÆ.

THE STARLINGS.

STARLING (*Sturnus vulgaris*)—Plate 12, fig. 40.—"A place is given this bird in the Fauna of North America," says Prof. Baird, "as an occasional and rare visitant of Greenland. It is a well-known cage bird; an interesting and entertaining pet. It has been taught to whistle tunes, and even to imitate the human voice. In its natural state it is very social, and lives in flocks." I have often listened to one which whistled most beautifully an operatic air. It was one of several fine singers belonging to Mr. Hoff, of Union Square, New York.

FAMILY—CORVIDÆ.

AMERICAN RAVEN (*Corvus corax; var. carnivorus*).—In New England this bird is extremely rare, though on the island of Grand Menan, off the north-east coast of Maine, it occasionally breeds. On the steep and almost inaccessible cliffs its nest is built, composed of twigs, sea-weed and pieces of turf, and lined with the softer algæ of the shores. The eggs are four or five in number, and almost exactly resemble those of the Crow, but are a little larger. The Raven is a general inhabitant of the United States, but is more common in the interior. On the lakes of the north-west, and particularly around Niagara Falls, they are abundant. Where the Ravens are common the Crows seldom frequent. The American Raven has been considered as identical with the species which Wilson says "is found almost all over the whole habitable globe." Baird says: "Most writers agree in considering this and the European species distinct, although Mr. Audubon maintained the contrary." The Raven is an excellent linguist, acquiring the art of conversation with wonderful rapidity, and retaining, with a singularly powerful memory, many sounds which it has once learned. Whole sentences are acquired, and repeated with great accuracy of intonation, the voice being a good imitation of human speech. The Raven is also noted for its longevity, many instances being known where it has attained the age of seventy or eighty years without losing its activity or brilliancy of eye. The color of the Raven is a uniform blue-black, with green reflections in certain lights. The female is always larger than the male. The food of this bird is almost entirely of an animal nature; they even exhibit a desire at times to attack wounded animals for purposes of prey.

WHITE-NECKED CROW (*C. cryptoleucus*).—This is a southern species, inhabiting the valley of the Rio Grande and Gila, and abundant on Llano Estacado. The general color is the same as in the Common Crow. "Its most striking, distinctive feature, however, is seen in the feathers of the neck all round, upper part of the back, and the whole breast, which are pure snowy-white for about their basal half. The feathers of the head are plumbeous at the base; the greatest intensity of white is on the lower part of the neck; the color fades out on the back and belly into plumbeous. In no other North American Crow is there any approach to this cottony whiteness. This character, with its smaller size, will at once serve to distinguish it from any other Ravens in the United States."—*Baird.*

COMMON CROW (*C. americanus*).—This familiar bird is abundant throughout North America to the Missouri region, and is also common on the coast of California, but is not found on the high central plains. In New England, during mild winters, it is resident through the year. The Crow is eminently gregarious in its habits. Says Wilson: "Towards the close of summer, the parent Crows, with their new families, forsaking their solitary lodgings, collect together, as if by previous agreement, when evening

approaches. About an hour before sunset they are first observed flying, somewhat in Indian-file, in one direction, at a short height above the tops of the trees, silent and steady, keeping the general curvature of the ground, continuing to pass sometimes till after sunset, so that the whole line of march would extend for many miles. This circumstance, so familiar and picturesque, has not been overlooked by the poets in their descriptions of a rural evening. Burns, in a single line, has finely sketched it:

'The blackening trains of Crows to their repose.'"

The Crow, besides feeding on grain and other vegetable matter, eats insects, frogs, small fish, lizards, shell-fish, and even carrion. It has a habit, when shell-fish are secured, of mounting to a considerable height, dropping them on the rocks below, and descending to feed on the contents. Instances are given of their seizing young chickens for food; and they destroy vast numbers of the eggs of various species of birds.

FLORIDA CROW (*C. americanus; var. floridianus*).—This variety is an inhabitant of the southern peninsula of Florida. "There are so many peculiarities in this bird as clearly to show that, if not a distinct species from the Common Crow, it is, at least, a very remarkable variety. Although, perhaps, rather smaller than the C. americanus, the bill and feet, especially the latter, are very considerably larger. The nasal feathers extend over the basal two-fifths of the bill instead of the half. The proportions of the bill are about the same; in the Florida bird it is rather the longer. The greatest difference is in the feet. The colors differ somewhat from those of the Common Crow. There is less violet, and the feathers of the back have almost a brassy gloss on their margins, as in Crotophaga. Bartram, in his list of N. A. birds (*Travels in Florida*), mentions a 'Corvus maritimus, Great Sea-side Crow,' but without specifying locality or giving any description. If a Florida bird, it quite probably refers to the present species, which is doubtless quite maritime in its habits."—*Baird.*

NORTH-WESTERN FISH CROW (*C. caurinus*).—Inhabiting Washington Territory and the north-western coast. This resembles the eastern Fish Crow in its habits. Dr. Cooper, of California, says: "They are maritime, feeding on the sea-beach at low tide, and coming about the settlements with considerable familiarity, being much less shy and suspicious than the Common Crow. The note, too, is said to be a little different." It is much like the Common Crow, differing somewhat in size.

FISH CROW (*C. ossifragus*).—"This bird," says Samuels, "is so extremely rare in New England, that it can be regarded only as an occasional straggler. It has been taken on Long Island, and, on one or two occasions, in Connecticut, in company with the Common Crow." Audubon says of it: "While on the St. John's River, in Florida, during the month of February, I saw flocks of Fish Crows, consisting of several hundred individuals, sailing high in the air, somewhat in the manner of the Raven. These aërial excursions would last for hours, during the calm of a fine morning, after which the whole would descend toward the water, to pursue their more usual avocations in all the sociability of their nature. When their fishing, which lasted about a half an hour, was over, they would alight in flocks on the live-oaks and other trees near the shore, and there keep up their gabble, pluming themselves for hours. The eggs resemble those of the Common Crow, but are smaller." This species is readily distinguished from the Common Crow by the much smaller size—sixteen inches instead of twenty; wing about eleven inches instead of thirteen. The bill is broaded at the base, and tapers more rapidly to the end. The tail is less rounded. The gloss on the belly is green instead of violet; that on the back is mixed with green, not entirely violet.

CLARK'S CROW (*Picicorvus columbianus*).—This is a little like the Jackdaw of Europe. It inhabits the region from the Rocky Mountains to the Pacific Ocean. It is remarkable for its powerful claws; so large and falcate are they, it would seem that this species is possessed of the power of seizing living prey, like the Hawks. It feeds mostly, however, on fish, frequenting the sea-shore and borders of large streams. It measures thirteen inches in length. "Its general color is bluish-ash, changing on the nasal feathers, the forehead, sides of head (especially around the eye) and chin, to white. The wings, including their inner surface, greenish-black; the secondaries and tertials, except the innermost, broadly tipped with white; tail white; the inner web of the fifth feather and the whole of the sixth, with upper tail coverts, greenish-black. The axillars plumbeous-black; bill and feet black."—*Baird.*

MAXIMILIAN'S JAY (*Gymnokitta cyanocephala*).—This is a species of Jay which was seen in the western territories by the Prince of Niewied, and named by him. Its general color is a dull blue, paler on the abdomen. The head and neck are of a much deeper and more intense blue, darker on the crown. It inhabits the Rocky Mountains and the cascades of California and Oregon, though probably not the Pacific Coast.

THE MAGPIE (*Pica caudata*)—Plate 11, fig. 38.—The American species is nearly like the European, differing only in its greater size and longer tail. Authors assert that the voice is quite different. The two are, however, undoubtedly of the same original stock. The Magpie is found distributed extensively over the western plains, from the Missouri River to the Pacific. In the more northern regions it is abundant. The nests were found by Mr. Ridgway in cedars, willows and in low shrubs. In every instance the nest was domed, the inner and real nest being enclosed in an immense thorny covering, which far exceeded it in bulk. In the side of this thorny protection is a winding passage leading into the nest, possibly designed to conceal the very long tail of the bird, which, if exposed to view, would endanger its safety. These birds prove exceedingly troublesome at times to parties traveling over the western plains; they annoy the weary and wounded animals, picking

their sore backs, and snatching all the food they can reach. Dr. Coues, in a pleasant description of their nesting, says: "Authors say that the American Magpie lays only two eggs; but I suppose that this particular pair lived too far from scientific centres to find out what was expected of them, as this nest contained six young ones, nearly ready to fly."

YELLOW-BILLED MAGPIE (*Pica caudata; var. nuttalli*).—This is considered a local race of the common kind, differing in some unimportant particulars. It is found almost exclusively in California. "Their food consists of almost everything animal and vegetable that they can find, and they come about farms and gardens to pick up whatever they can meet with. They have a loud call that sounds like *pait—pait*, with chattering notes, in tone resembling the human voice, which, indeed, they can be taught to imitate."

BLUE JAY (*Cyanura cristata*)—Plate VI. fig x. —The Blue Jay is found widely distributed over the North American continent. "The entire family to which this Jay belongs, and of which it is a very conspicuous member, is nearly cosmopolitan as to distribution, and is distinguished by the remarkable intelligence of all its members. Its habits are striking, peculiar, and full of interest, often evincing sagacity, forethought and intelligence strongly akin to reason. These traits are common to the whole family."—*North American Birds.* Wary as this bird is in the settled parts of the country, in the western prairies it is, says Mr. Allen, half domestic. In one of the principal streets of Richmond, Indiana, he found a nest, built in a lilac bush, under the windows of a dwelling. In Kansas the Jay is equally familiar, and is more highly colored than at the North. The voice of the Blue Jay is remarkably flexible, being attuned either to soft and musical notes, to the harshest screamings of the Hawk tribe, or the most ear-rending shrieks, resembling nothing so much as the piercing creaks of an ungreased wheel. Wilson says of him: "He appears to be among his fellow musicians what a trumpeter is in a band, some of his notes having no distant resemblance to the tones of that instrument. These he has the faculty of changing through a great variety of modulations, according to the particular humor he happens to be in. When disposed for ridicule, there is scarce a bird whose peculiarities of song he cannot tune his notes to. When engaged in the blandishments of love, they resemble the soft chatterings of a duck; and, while he nestles among the thick branches of the cedar, are scarce heard at a few paces distant. But he no sooner discovers your approach than he sets up a sudden and vehement outcry, flying off and screaming with all his might, as if he would call the whole feathered tribe to witness some outrageous usage he had received. When he hops among the high branches of the oak and hickory, they become soft and musical. All these he accompanies with various nods, jerks and other gesticulations for which the whole tribe of Jays are so remarkable. The power of mimicry possessed by the Jay, though different from, is hardly surpassed by that of the Mocking-bird. It imitates the cry of a Hawk so closely as to drive the small birds to cover, and excite immediate consternation in the poultry yard. An experienced bird fancier asserts that he has invariably found them more ingenious, cunning and teachable than any other species of bird he has ever attempted to instruct. The Blue Jay appears to belong exclusively to North America."

STELLER'S JAY (*Cyanura stelleri*).—This species is found on the Pacific Coast, from the Columbia River to Sitka. Dr. Luckley regarded Steller's Jay as probably the most abundant bird of its size in all the wooded country between the Rocky Mountains and the Pacific. He describes it as tame, loquacious, and possessed of the most impudent curiosity. It is remarkable for its varied cries and notes, and seems to have one for every emotion or pursuit in which it is engaged. It has also a great fondness for imitating the notes of other birds. Mr. J. K. Lord states that this Jay ever makes its presence known by the constant utterance of discordant screams. It is continually hopping from bough to bough, darting down to catch an insect, performing short, erratic flights, and jerking up and down its crest of bright feathers. A variety of this Jay is called frontalis; and another the mæsolopha. The latter is the Long-crested Jay; it is very similar to C. stelleri, but is readily distinguished on comparison. The most striking peculiarities are the much longer and fuller crest; the streaks on the forehead white, not blue; and the patch over the eye, not found at all in stelleri. The head is much blacker, the crest feathers having also a gloss of blue instead of opaque dark brown. The back is dusky bluish-ash, not opaque brown. The chin is more gray; the blue of the breast extends farther forward, and is much less abruptly defined. The black bands on the wing feathers are more distinct, especially those on the greater wing coverts, which, obsolete in stelleri, are very conspicuous in the other. Besides the peculiarities of coloration, the bill is more slender, and the tail is less rounded.

Cyanocitta.—This genus has much the general character of Cyanura, or the Blue Jays, but is readily distinguished by the absence of a crest, and of black bars on the wings and tail. The wings generally are shorter; otherwise, it appears to be much the same.

FLORIDA JAY (*Cyanocitta floridiana*).—"This species is similar to C. woodhousei, in color of the under parts, including the brown belly, the blue crissum, the pectoral band, etc. The back, however, is much lighter and better-defined gray, more so, even, than in C. californica. It differs from both species in the hoary on the forehead and sides of the crown, and in the absence of the superciliary line of white spots, as, also, in being considerably smaller."—*Baird.*

CALIFORNIA JAY (*C. californica*).—This species is found on the Pacific Coast, from the Columbia River, southward, but not in the interior.

WOODHOUSE'S JAY (*C. woodhousei*).—This is a variety of the latter. Baird says it has so close a relationship to C. californica that it may not seem proper to separate them; but the differences are very perceptible in large series. Habitat, central line of Rocky Mountains to Table-lands of Mexico.

ULTRAMARINE JAY (*C. ultramarina*).—"This well-marked species," says Prof. Baird, "is quite different in form from the C. californica, having a shorter, more even tail, much longer wings and stouter feet. The absence of any collar or streaks on the breast and throat, of black or white on the sides of the head, and of decided ash on the back, are very well-marked features. There is also much more green in the blue of the head. It is found in the valley of the Rio Grande, near the coast. Its size is between the two latter." Two varieties are named by Prof. Baird. One is called arizonæ, and the other couchi. "The latter," says Prof. Baird, "I shall propose to call couchi, in honor of its indefatigable discoverer, Lieut. D. A. Couch, of the United States army, who, at his own risk and cost, undertook a journey into Northern Mexico when the country was swarming with bands of marauders, and made large collections in all branches of zoölogy, which have furnished a great amount of information respecting the natural history of our borders."

Xanthoura.—This genus is most easily recognized by the prevailing green color of the body, the blue head, black throat, and yellow outer tail feathers. The bill is stouter and larger than in any of our other Jays, and the culmen more curved. The chief peculiarity of form is seen in the wings, in which the primaries are remarkably short, scarcely longer than the longest secondaries and tertials. They thus reach only about as far as the end of the upper tail coverts, instead of much beyond them, a character quite peculiar among the American *Corvidæ*, except approximately in Psilorhinus.

GREEN JAY (*Xanthoura incas; var. luxuosa*).—This is from the valley of the Rio Grande of Texas, and southward. The size of this bird is about the same as that of the preceding. It is peculiar in its color, being green above and yellow beneath, glossed with green. The sides of the head and beneath, from the bill to the fore-part of the breast, are velvet-black. The bill is black, and the feet lead color.

CANADA JAY (*Perisoreus canadensis*).—This is a genus which includes the dullest colored of the Jays. The bill is shorter, and is notched at the tip. It is about the size of the smaller Cyanuras. It is found from the Atlantic to the Pacific, in the more northern portion of the continent. Audubon says: "The Canada Jay breeds in Maine, in New Brunswick, and as far north as Labrador. This bird is not so well known as the Blue Jay, but is equally rapacious, and resembles the latter in its cry and in its motions. Like the latter, also, it occasionally preys upon the young of other birds, and will not, when pressed by hunger, refuse carrion. The Canada Jay has been observed to arrive in the Hudson River region about the commencement of cold weather. It seemed to seek the most unfrequented shaded retreats, keeping almost constantly on the ground, yet would sometimes, toward evening, mount to the top of a small tree and repeat its notes—which a little resemble those of the Baltimore—for a quarter of an hour together; and this it generally did before snow or falling weather." An Alaskan variety is known (var. obscurus), and also a Rocky Mountain variety (capitalis.)

BROWN JAY (*Psilorhinus morio*).—This is a fine, large species, found in the Rio Grande Valley

FAMILY—TYRANNIDÆ.

The *Tyrannidæ* form a family which is strictly one of this hemisphere alone. They are largely distributed in the tropical parts of America; though one of the principal forms is the King-bird, or Tyrant Fly-catcher, which is so commonly known in the Northern States. They have a very Shrike-like bill, and many of the habits of the Shrike—not only preying upon insects, but occasionally attacking other birds, reptiles, and even fishes. Their name is derived from their combative habits, as they are so pugnacious as to attack even birds of much greater size and power than themselves.

THE FORKED-TAILED FLY-CATCHER (*Milvulus tyrannus*).—This species claims a place in the Fauna of the United States on account of two specimens captured in New Jersey, at long intervals, and one or two seen by Mr. Audubon in the south-west. "Habitat, South America; accidental in the United States."—*Baird.* Its length is fourteen inches; wing, four and three quarters; tail, ten inches; and depth of fork, seven inches.

SCISSOR-TAIL; SWALLOW-TAILED FLY-CATCHER (*Milvulus forficatus*).—This is an exceedingly graceful bird, inhabiting Texas and Mexico. It derives one of its trivial names from the fact that it opens and shuts its tail like the action of a pair of scissors. It is thirteen inches in length, and has the same length of wing as the latter species.

KING-BIRD (*Tyrannus carolinensis*).—This bird, called also BEE MARTIN, is common in all parts, from the Atlantic to the Rocky Mountains, and is sometimes seen in Washington Territory. It is abundantly distributed throughout New England as a summer resident, arriving from the south about the 1st of May. The pugnacity of the King-bird is proverbial. Mr. Samuels describes his habits in this wise: "During the mating and breeding season, if any bird approach the neighborhood of its nest, he immediately attacks it; and, whether Crow (his particular dislike), Hawk or Eagle, the intruder is obliged to flee, so fierce an onslaught does this little warrior make on him. As soon as the cry of a Crow is heard, he is all activity; he flies from the tree where he is perching to reconnoitre, uttering his shrill twitter, and vibrating his wings in short, quick, nervous strokes; as soon as the Crow appears, the King-bird pursues it, his flight now being very swift and powerful. As soon as he nears his foe, he flies above him, and, darting down on his back and head, attacks him with such vigor that the Crow dodges and dives to avoid him. He repeats his attack, and follows his enemy, sometimes to the distance of a mile or more; then, returning to his mate, he perches on the tree by her nest, and twitters a volley of courageous songs." The King-bird, as well as all the Fly-catchers, takes its insect food on the wing. See also Vol. i, p. 335

GRAY KING-BIRD (*T. dominicensis*). — "This is about the same size as the former species, but is much more powerfully built, the bill and feet being much stronger. It is a constant summer visitor to the coast of Florida and the West Indies, and a pair has been observed at Charleston by Audubon."—*Baird.*

ARKANSAS FLY-CATCHER (*T. verticalis*).—This is found only in the western portions of North America. The length of the body is a trifle more than in the preceding species, but the wing is shorter. The tail is slightly forked.

CASSIN'S FLY-CATCHER (*T. vociferans*).—The habitat of this bird is from the valley of the Gila eastward to Pecos River, Texas, and into Mexico, on Table-lands. It closely resembles the preceding, but has rather larger legs and bill. The quills are much more abruptly attenuated. The tail is more even, and in some specimens it is slightly rounded.

COUCH'S FLY-CATCHER (*T. couchi*).—This is another southern species, found in North-eastern Mexico and on the Rio Grande. Its length is a trifle more than that of the latter, but its wing is shorter. Its tail is longer. The variety melancholicus is now considered the same as this, and in the late work of Prof. Baird the latter specific name is adopted.

GREAT-CRESTED FLY-CATCHER (*Myiarchus crinitus*).—This is a notable member of a well-marked genus. It is a rare bird in New England, and is seldom seen as far north as the middle of Maine. It breeds in Massachusetts and the more southern States. Wilson says: "They do not, to my knowledge, winter in any of the Southern States."

ASH-THROATED FLY-CATCHER (*M. crinitus; var. cinerescens*).—Found on the coast of California and in North-eastern Mexico.

BLACK FLY-CATCHER (*Sayornis nigricans*).—This bird is found in the western portions of North America, California and Oregon. It is somewhat smaller than the preceding, being seven inches in length and three inches and a half in the wing.

PHŒBE, PEWEE (*Sayornis fuscus*).—The Pewee is a well-known bird in the Northern States, in summer, arriving from the south in March, frequently before the snow disappears. In Pennsylvania it arrives in the first week in March, and leaves as late as November. Wilson says: "The notes of the Pewee, like those of the Blue-bird, are pleasing—not from any melody they contain, but from the ideas of spring and returning verdure, with all the sweets of this lovely season, which are associated with his simple but lively ditty."

SAY'S PEWEE (*L. sayus*). — This is found in the west, from the Missouri to the high central plains, thence to the Pacific, and south to Mexico. It is the same as the preceding in length, but with a much longer wing, and the tail a little longer.

OLIVE-SIDED FLY-CATCHER (*Contopus borealis*). —"This genus," says Prof. Baird, "is pre-eminently characterized, among North American Fly-catchers, by the very short tarsi and the long and much-pointed wings." This species is considered rare on the Atlantic Coast, although Prof. Verrill says that it "breeds quite common near the Umbagog Lakes, in Maine. It also has been found breeding in Vermont and in Massachusetts. The nests are very similar to the preceding."

WOOD PEWEE (*C. virens*).—This is a common summer inhabitant of New England, usually choosing the solitudes of the deep forests for its abode. The nest of this species is always a wondrous affair, and very beautiful. Nuttall thus describes it: "It is extremely neat and curious, almost universally saddled upon an old moss-grown and decayed limb, in a horizontal position, and is so remarkably shallow and incorporated upon the branch as to be easily overlooked. The body of the fabric consists of wiry grass and root fibres, often blended with small, branching lichens, held together with cobwebs and caterpillars' silk, moistened with saliva. Externally, it is so coated over with bluish, crustaceous lichens as to be hardly discernible from the moss of the tree. It is lined with finer root fibres and slender grass stocks." There is a peculiar symmetry and cup-like finish to this nest, which is only equalled by that of the Humming-bird. The eggs are four in number, and are very beautiful, being of a delicate cream color, with blotches and spots of lilac and brown around the larger end.

THE MEXICAN OLIVE-SIDED FLY-CATCHER (*C. pertinax*) is found in Mexico generally, and on the southern borders of the United States. It is abundant at Vera Cruz.

SHORT-LEGGED PEWEE (*C. virens; var. richardsoni*).—This species is closely related to C. virens. The wings and tail differ somewhat in proportion, the latter being more deeply forked. It is seen in the western country, from the high central plains to the Pacific, and southward to Mexico.

LITTLE FLY-CATCHER (*Empidonax pusillus*). — The genus Empidonax is readily distinguished in the species by their lengthened tarsi, short toes, short and rounded wings, and the plain, dull, olivaceous of the plumage. This species inhabits the high central plains to the Pacific, and southward to Mexico.

TRAILL'S FLY-CATCHER (*E. pusillus; var. traillii*) is occasionally found as a visitor in New England. It is sometimes found breeding in Massachusetts.

LEAST FLY-CATCHER (*E. minimus*).—This is very abundant throughout the Eastern States in summer, and is familiar both to the town and country.

SMALL GREEN-CRESTED FLY-CATCHER (*E. acadicus*).—"This is a rare bird in New England, and is not often seen even in other portions of North America, though its range is from the Atlantic to the Mississippi. It inhabits the deepest, thick-shaded woods; sits generally on the lower branches; utters, every half minute or so, a sudden sharp squeak, which is heard a considerable way through the woods; and, as it flies from one tree to another, has a low, querulous note, like the twitterings of chickens nestling under the wings of a hen. On alighting, this sound ceases, and it utters its notes as before."— *Wilson.*

YELLOW-BELLIED FLY-CATCHER (*E. flaviventris*). —This inhabits the Eastern United States, though it does not appear to be much known in New England. It is about the size of E. minimus, though rather stouter. The variety E. difficilis is found westward.

WRIGHT'S FLY-CATCHER (*E. obscurus*) is found in the Rocky Mountains of Texas. "The most decided character of this species is seen in the combination of the narrow bill and the white outer margin of the external tail feather, together with the long tarsi. The colors are much like those of minimus and trailli; the yellow beneath is, however, more ochraceous."—*Baird.*

HAMMOND'S FLY-CATCHER (*E. hammondi*).—"This species is at once distinguished from all the North American Tyrannulas, except obscurus, by the extreme narrowness of its bill. Its colors above are those of acadicus, while the general effect is much more that of flaviventris, although less brightly olive. The tail, instead of being nearly even, is quite deeply forked. The differences from obscurus are less easily expressed. It is, however, considerably smaller and more olivaceous above and below. The tarsi are much shorter. The most tangible character is seen in the absence of white on the outer web of the external tail feather, which is only a little paler brown than elsewhere. This species inhabits the region about Fort Tejon and Los Angeles."—*Baird.*

BUFF-BREASTED LEAST FLY-CATCHER (*Mitrephorus fulvifrons*).—Found in the southern border of the Middle Province of the United States, also at Fort Whipple and in Arizona.

RED FLY-CATCHER (*Pyrocephalus rubineus*).—This genus is shaped something like saxicola. Its single North American species is readily distinguished among other Fly-catchers by the bright red of the under parts. The species is very showy, the crown and whole under parts being bright carmine in color. The head has a full rounded or globular crest. It is from the valleys of the Rio Grande and Gila.

FAMILY—ALCEDINIDÆ.

BELTED KINGFISHER (*Ceryle alcyon*).—This is a very familiar bird in the Northern States, and is a very common summer inhabitant of New England. Sometimes it is seen in Maine in the winter. Its food is chiefly fish. "He courses along the windings of the brook or river, at a small height above the surface—sometimes suspending himself by the rapid action of his wings, like certain species of Hawks, ready to pounce on the prey below—now and then settling on an old, dead, overhanging limb to reconnoitre. Mill-dams are particularly visited by this feathered fisher; and the sound of his pipe is as well known to the miller as the rattling of his own hopper. Rapid streams, with high, perpendicular banks—particularly if they be of a hard, clayey or sandy nature—are also favorite places of resort for this bird, not only because in such places the small fish are more exposed to view, but because those steep and dry banks are the chosen situations for his nest. They are very tenacious of their haunts, breeding for several successive years in the same hole, and do not readily forsake it, even though it be visited."—*Wilson.* The sight of the Kingfisher is singularly keen, and even when passing with its meteor-like flight over the country, it will check itself suddenly in mid career, hovering over the spot for a short time, watching the fishes as they swim, and then, in a peculiar, spiral manner, plunging in to secure its prize. It is found over the entire continent.

FAMILY—CAPRIMULGIDÆ.

WHIP-POOR-WILL (*Antrostomus vociferus*)—Plate IV, fig. i.—This is a very familiar bird in the Northern States, though it is seldom seen. Many have heard its plaintive notes who entertain a superstitious dread on account of the peculiar time and manner of utterance. It inhabits the most secluded spots of the deep woods, and sallies forth at night only, in search of insect food, which consists largely of the great nocturnal moths. Its peculiar note is heard at early eve, hardly before dark, and is continued into the night. "Its notes," says Wilson, "seem pretty plainly to articulate the words which have been generally applied to them—*Whip-poor-will!*—the first and last syllables being uttered with great emphasis, and the whole in about a second to each repetition; but when two or more males meet, their Whip-poor-will altercations become much more rapid and incessant, as if each were striving to overpower or silence the other. When near, you often hear an introductory *cluck* between the notes. At these times, as well as at almost all others, they fly low—not more than a few feet from the surface—skimming about the house and before the door, alighting on the wood-pile or settling on the roof. Towards midnight they generally become silent." "The Whip-poor-will is nowhere a resident species in any portion of the United States. They make their appearance in the Southern States early in March, and very gradually proceed northward, reaching New England about the 10th of May. It is exclusively nocturnal, keeping, during the day, closely within the recesses of dark woods, and remaining perfectly silent, uttering no note even when disturbed in these retreats. In very cloudy weather, late in the day, these birds may be seen hunting for insects; but this is not usual, and they utter no sound until it is quite dark. The cry is never uttered when the bird is in motion, but usually at short intervals, when resting on a fence or bush or any other object near the ground. Their flight is noiseless to an incredible degree, and they rarely fly far at a time."—*North American Birds.* This bird resorts to various expedients to deceive intruders into the belief that it is wounded. The female has no nest, but deposits her eggs among the fallen leaves in the shadiest portion of the woods, where she remains until nearly trodden on. When obliged to leave, she will suddenly flutter from her place, and limp away, with wings and tail awry, and having every appearance of being wounded.

CHUCK-WILL'S-WIDOW (*A. carolinensis*).—This species is seldom seen north of Virginia, and is more common in Florida than any other section. Its habits are the same as those of the preceding species. Audubon describes the removal of the eggs and young by this bird when the nest has been disturbed. He says that they are conveyed in their capacious

mouths, each parent taking one. In shape and markings they closely resemble the Whip-poor-will, differing chiefly in their much larger size.

NUTTALL'S WHIP-POOR-WILL (*A. nuttalli*).—This bird is readily distingnished from the other North American species by the transverse, not longitudinal, lines on the top of the head, the narrow white tip of tail on both webs, and the inferior size, as well as by other points of difference. Audubon first described it from a specimen captured in the Rocky Mountains. Mr. Nuttall found it on the Upper Platte River. In all parts of Oregon and California it is seen. Mr. Ridgway describes its notes as "much like those of the Whip-poor-will of the Eastern States, except that the first syllable is left off, the call sounding like simply '*poor-will!*' the accent on the last syllable. It frequents the dry *mesa* and foot-hills of the mountains, and lives almost entirely on the ground, where its two white, unspotted eggs are deposited beneath some small, scraggy sage-bush, without any sign of a nest whatever." Both sexes incubate.

NIGHT HAWK (*Chordeiles popetue*).—This is a well-known bird in the Northern and Eastern States during the summer months. At early twilight they may be seen coursing through the air, above the trees or houses, in search of insects. Their flight is very rapid, their long wings giving quick, powerful sweeps; and as they dash about in many eccentric movements, busily gleaning their food, they utter, at oft-repeated intervals, their short note, or squeak, which almost exactly resembles that of the Common Snipe. In most portions of New York City these birds may be heard in their season. During the twilight, they are heard uttering their peculiar notes directly over the noisy streets, yet few of the denizens of the great city have any knowledge of them. The great abundance of insect life in the vicinity of our large cities attracts them. Dr. Brewer says: "The modern style of house-building, with flat Mansard roofs, has also added to the inducements, affording safe and convenient shelter to the birds at night, and serving also for the deposition of their eggs. In quite a number of instances they were known to lay their eggs, and to rear their young, on the flat roofs of houses in the city. Instances of this have been seen in Philadelphia also. The movements, evolution and general habits of this species, in the pursuit of prey, bear little resemblance to those of the *Antrostomi.* but are much more like those of the *Falconidæ.* They fly high in the air—often so high as to be hardly visible—and traverse the air, moving backward and forward in the manner of a Hawk. At times they remain perfectly stationary for a few moments, and then suddenly and rapidly dart off, their wings causing a very peculiar vibratory sound. As they fly they utter a very loud and shrill cry, which it is almost impossible to describe, but often appearing to come from close at hand when the bird is high in the air."—*North American Birds.* There is a striking difference in the breeding habits of the several members of this family. While the Whip-poor-will selects the shady, secluded forests, the Night Hawk lays her eggs on the barren heath or dry, open pasture; frequently on a flat rock. The moss-covered rocks of these localities are so near the color and markings of the bird, her eggs and her young, that, though it may seem a lack of parental care in thus carelessly dropping her eggs, yet doubtless there is as much safety in this very absence of care as in any other case. Wilson says: "As soon as incubation commences, the male keeps a most vigilant watch around. He is then more frequently seen playing about in the air above the place, even during the day, mounting by several quick vibrations of the wings, then a few slower, uttering all the while a sharp, harsh squeak, till, having gained the highest point, he suddenly precipitates himself, head foremost, and with great rapidity, down sixty or eighty feet, wheeling up again as suddenly. At this instant is heard a loud, booming sound, very much resembling that produced by blowing strongly into the bung-hole of an empty hogshead, and which is doubtless produced by the sudden expansion of his capacious mouth while he passes through the air. This singular habit belongs exclusively to the male. The female has, indeed, the same hoarse note, and much the same mode of flight, but never precipitates herself in the manner of the male."

WESTERN NIGHT HAWK (*Chordeiles popetue; var. henryii*).—This species was first described by Mr. Cassin in 1855, from specimens procured in New Mexico by Dr. Henry, in whose honor it is named. It is differently colored, and in other respects varies from the Common Night Hawk. The habits are precisely the same in the two. It inhabits the western provinces of North America, except the Pacific Coast region and Texas.

TEXAS NIGHT HAWK (*C. acutipennis*).—This southern bird has the markings quite different from those of the popetue, and is much smaller. Mr. Lawrence first described it as a new species in 1856. In most respects it resembles the others in habits; though it is not known to make the downward swoop, neither does it utter the hoarse note, nor sail so high in air.

FAMILY—CYPSELIDÆ.

This family includes the Swifts, or Swallow-like birds. They were formerly associated with the Swallows, but are now found to differ essentially in structure, and are rightly considered to form a separate order. They are found to be closely related to the Humming-birds. The Swifts are found in all parts of the globe; the Chimney Swallow being the most familiar example in America. The edible nests of China and Japan are made by a small species of this family. They have the salivary glands largely developed, and the secretion, in the case of the eastern species, forms the only ingredient in the construction of the nest. In those of the Chimney Swallow, the twigs are glued together by the saliva. The eggs are pure white in all the species. A species of Guatemala forms a tube several feet in length on the under side of an overhanging rock, the material being the down of plants, which the bird catches

while flying in the air. The entrance to this nest is from below, the eggs being laid on a sort of shelf near the top. A curious nest is constructed by a Brazil species. It is tube-shaped somewhat like the latter, suspended to a branch, and covered with feathers on the outside. There is no shelf for the eggs, and it is believed that they are cemented against the sides of the tube, and brooded on by the bird while in an upright position.

WHITE-THROATED SWIFT (*Panyptila melanoleuca*).—This is a new species, discovered by Dr. Kennerley in New Mexico, in 1854. In its flight and habits it closely resembles the Common Chimney Swallow of the east. It inhabits the Western Territories and the Southern Rocky Mountains to Guatemala.

BLACK SWIFT (*Nephœcetes niger*).—This is a southern and western bird. Dr. Gundlach saw them in Cuba, and, among other things, states that when one of these birds flies in chase of another, it emits a soft, continued note, not unlike a song.

CHIMNEY SWALLOW (*Chætura pelagica*).—This is the most familiar form of the family in America. It has a wide range, extending from the Atlantic to the Fiftieth Parallel. It differs from the European Swift in its habits. While the latter is shy, and builds in caves or deserted habitations, our bird seeks the abode of man, and seems to choose the chimneys of inhabited dwellings preferably. The Chimney Swallow is seen to be more active at twilight, finding, probably, its proper food in the insects that are abroad at that time of the day. The nest is one of the most interesting of all like structures. "It is composed of small twigs of nearly uniform size, wrought and interwoven into a neat and semicircular basket. In selecting the twigs with which they are to construct their nests, the Swifts break from the tree the ends of living branches, which they gather with great skill and adroitness while on the wing. Sweeping upon the coveted twig somewhat as a Hawk rushes on its prey, it divides it at the desired place, and bears it off to its nest. Each one of these twigs is strongly fastened to its fellows by an adhesive saliva secreted by the bird, and by the same cement the whole structure is made to adhere to the side of the chimney in which it is built. This saliva, as it dries, hardens into a tough, glue-like substance, as firm even as the twigs it unites. In separating nests from the sides of chimneys, I have known portions of the brick to which it was fastened part sooner than the cement. When moistened, however, by long-continued rains, the weight of their contents will sometimes cause these nests to part, and the whole is precipitated to the bottom. The young birds cling very tenaciously to the sides of the chimney, with their bills and claws. They not only are often able, in these accidents, to save themselves from falling, but even at a very early age can cling to the sides of the chimneys with their bills, and work their way to the top. They always leave their nest and climb to the upper part of the chimney several days before they can fly, and are there fed by their parents. In New England the Chimney Swallow raises but one brood in a season. In Pennsylvania it is said to have two."—*North American Birds.*

OREGON CHIMNEY SWIFT (*Chætura pelagica; var. vauxi*).—This species is much like the preceding, but is considerably smaller. The wing is nearly an inch shorter, and the tarsus and middle toe are longer. Some differences are noticeable, also, in the color of the plumage. Its habits are the same. It is found on the Pacific Coast, from Puget's Sound to California, and in Guatemala and Yucatan.

FAMILY—TROCHILIDÆ.

THE HUMMING-BIRDS.

The Humming-birds are strictly confined to the continent and islands of America, none being found in the Old World. They are most abundant in Central America and in the tropical portions of South America. Single species are occasionally seen quite near the Arctic regions, and as far south as Patagonia. The food of these birds consists largely of insects, which they capture by inserting the bill among the petals of the flowers. One hundred and thirty genera are now established. Seven genera are represented only in North America, having ten species. The habits and manners of the Humming-birds are peculiar, differing very markedly from any other kind of birds. Their flight and movements generally resemble those of insects. They are so nearly like the great nocturnal Sphinxes in their flight, that it is difficult to distinguish between them. The Humming-bird is not seen in forests, but loves the sunshine. Some are more in the habit of feeding at twilight, but this is probably because the insects they are in search of are more abundant at that period. Though they feed mostly upon insects, yet the nectar of flowers is also a portion of their nourishment. The pugnacious habits of these little creatures are well known. They attack without hesitation larger birds, when they come in their way, and the large Moths and Sphinxes are driven off and beaten by them, in their efforts to secure their food. Curiously enough, the Humming-bird has been known to attack so large a bird as the Sparrow Hawk, and to drive him off—conquer him. Though not able to inflict deadly injury, his ability to flit around his enemy with lightning rapidity, enables him to make rapid thrusts at his eyes, when the Hawk is quite ready to retreat, as a Lion would be at the stinging of a Gnat. The nest of these birds is a marvel of beauty. The eggs are always two in number, and pure white—the only difference being in size.

THE CALLIOPE HUMMING-BIRD (*Stellula calliope*).—This is a new species, first brought to the attention of naturalists by one of the Commissioners of the North-western Boundary Survey. It is found in the mountains of Washington Territory, Oregon and California, to Northern Mexico. Though generally fond of the warm sunshine, and rarely seen excepting in summer, the present species, and one other, were observed while the snow was yet on the ground in patches. They were flitting around the flowers of

Ribes, or flowering currant, the brilliant flowers of which were then in bloom on the Little Spokan River. The length of this species is 2.75; wing, 1.60; tail, 1.00.

RUBY-THROATED HUMMING-BIRD (*Trochilus colubris*).—This is the familiar Humming-bird of our Eastern States, and is the best known of all our species. It is found from the Atlantic to the Missouri Valley, and breeds from Florida and the valley of the Rio Grande to high northern latitudes. Dr. Brewer says: "They nest in Massachusetts about the 10th of June, and are about thirteen days between the full number of eggs and the appearance of the young. They resent any approach to their nest, and will even make angry movements about the head of the intruder, uttering a sharp outcry. Other than this, I have never heard them utter any note." Wilson describes its nest as follows: "This is generally fixed on the upper side of a horizontal branch, not among the twigs, but on the body of the branch itself. Yet I have known instances where it was attached by the side to an old moss-grown trunk, and others where it was fastened on a strong rank stalk or weed in the garden; but those cases are rare. In the woods it very often chooses a white-oak sapling. The nest is about an inch in diameter, and as much in depth. A very complete one is now lying before me, and the materials of which it is composed are as follows: The outward coat is formed of small pieces of a small species of bluish-gray lichen, that vegetates on trees and fences, thickly glued on with the saliva of the bird, giving firmness and consistency to the whole, as well as keeping out moisture. Within this are thick, matted layers of the fine wings of certain flying seeds, closely laid together; and lastly, the downy substance from the great mullein, and from the stalks of the common fern, lines the whole. The base of the nest is continued round the stem of the branch, to which it closely adheres; and, when viewed from below, appears a mere mossy knot or accidental protuberance."

BLACK-CHINNED HUMMING-BIRD (*T. alexandri*).—This species is found from the highlands of Mexico to the fifty-eighth parallel northward. Dr. Heerman first added it to the Fauna of the United States, having found it in Sacramento City, California. The nests, he remarks, are essentially similar to those of the colubris. Dr. Cooper found them along the Mohave River. He says of the nests: "They were all built of white down from the catkins of the willow, agglutinated by the saliva of the bird. They were thus fastened to the end of the hanging branches of the Sycamore." Mr. J. K. Lord, one of the Commissioners to the North-western Boundary Survey, gives definite information concerning the insectivorous character of this species. He says: "On a number of black birch trees a sweet, gummy sap exuded plentifully, and on this sap hosts of insects, large and small, were regaling themselves. As the sap was very sticky, numbers of the small-winged insects were trapped in it. Busily employed in picking off and devouring these captive insects were several very sombre-looking Humming-birds, poising themselves over the flower, and nipping off, as with delicate forceps, the imprisoned insects." The stomachs of those he killed were found filled with various kinds of winged insects. The bird is found nesting in the lowest valleys, and to the height of eight or nine thousand feet.

ANNA HUMMING-BIRD (*Calypte anna*).—Another of the western species, found in Mexico and the coast region of California. It is named in honor of Anna, Duchess of Rivoli. Audubon figures a specimen, the first which had been captured in the States. Its nest is not so neat as that of the eastern species. Dr. Gambell considers it a very common species in California, and adds that it passes the entire winter there. During the breeding season they are very pugnacious, darting like meteors among the trees, uttering a loud and repeated twittering scold. Dr. Cooper says: "The notes of the male bird are like the sound produced by the filing of a saw or the whetting of a scythe."

COSTA'S HUMMING-BIRD; RUFFED HUMMER (*C. costæ*).—This is a Mexican bird, abundant in the valleys of Sierra Madre, and extending into New Mexico, Southern California and Arizona. It is named in honor of the Marquis de Costa, of Chambery. The notes uttered by the male resemble the highest and sharpest which can be drawn from a violin.

RUFOUS-BACKED HUMMING-BIRD (*Selasphorus rufus*).—This is found on the west coast of North America, and across from the gulf of California to the Upper Rio Grande Valley, and along the Table-lands of Mexico. It is a brilliantly-colored species, and is decorated with a curious ruff upon its throat. The first one found was by Capt. Cook, the celebrated voyager and navigator, in Nootka Sound. They are common summer residents at Sitka. Dr. Cooper states: "The male of this species has a remarkable habit, when a stranger or wild animal approaches its nest, of rising to a great height in the air, and then darting down perpendicularly upon the intruder, producing a hollow, rushing sound, like that of the Night Hawk, but of a much sharper tone." These sounds, he says, are produced by the wings. When perching, this species is said to utter a shrill, wiry call. They also produce a curious kind of bleating sound. Mr. Nuttall compares the appearance of the male to an angry coal of brilliant fire, as they darted upon him, passing within a few inches of his face, as they returned again and again to the attack, making a sound as of a breaking twig.

BROAD-TAILED HUMMING-BIRD (*S. platycercus*).—This species inhabits the Table-lands of Mexico and the Rocky Mountains, and as far north as Wyoming Territory. It is larger and somewhat different from the Ruby-throat of the east in its markings, yet it is at first sight easily mistaken for the latter. Dr. Palmer procured nests, which were considered large for the size of the bird, being unusually broad and shallow, but made much like those of other species. It displays considerable pugnacity. Mr. Ridgway saw a male repeatedly drive away a Hawk (Accipeter fuscus). He also observed that this bird was accompanied in its flight by a peculiar

shrill, screeching buzz of extraordinary loudness, to be produced by such a small creature. This sound Mr. R. noticed when the bird was passing overhead, in a manner not observed in any other species, its horizontal flight being by a peculiar undulating course. The shrill noise made by the male of this species, he suggests, may be caused by the curious attenuated and stiffened outer primary.

HELOISA'S HUMMING-BIRD (*Atthis heloisa*).—This is a Mexican and Central American species. Mr. Salvin found it as far south as Guatemala. It goes forth to feed only in the evening and morning. It resembles the Selasphorus in shape, and differs so little from species of that genus that they are easily mistaken on first view.

XANTUS' HUMMING-BIRD (*Heliopædica xantusi*).—This is so distinct that it requires no comparison with any other species. It is new to the North American Fauna, having been described by Mr. Lawrence in 1860, from specimens found by Mr. Xantus at Cape St. Lucas.

LINNÆUS' EMERALD (*Thaumatias linnæi*).—This is a South American bird, and is introduced into our Fauna on the authority of Mr. Wm. Brewster, of Boston, who shot a straggler near that city.

FAMILY—CUCULIDÆ.

This is a strongly-marked group of birds, having the toes in pairs, deeply cleft or not united, the outer anterior toe usually versatile, but directed rather laterally than backward.

PAISANO; ROAD-RUNNER; CHAPARRAL COCK (*Geococcyx californianus*).—This is the only species of the genus found within the limits of the United States. Another occurs in Mexico (the G. affinis), which is smaller. The present species has been called by one of its trivial names on account of its frequenting the public highways. It is also called the Ground Cuckoo and the Prairie Cock. It is abundant in Arizona, New Mexico and Texas, where it has the reputation of being remarkably fleet of foot. In some sections it is hunted for amusement on horseback, and even with hounds. Though having the terrestrial habits of the gallinaceous birds, it has no affinities thereto, but belongs to the Cuckoos. Its food consists of insects, and even terrestrial shell-fish. Though generally confined to the ground, when suddenly alarmed it takes wing and shows itself an able flier. Its nest is constructed somewhat after the style of that of the Yellow-billed Cuckoo, the eggs being large, white and nearly spherical. It is unsocial, never seen in flocks, and has for a note only a weak scream, which it seldom utters. Dr. Cooper says he heard one making a low cooing noise like that of a Dove, for which it was first mistaken; afterwards he heard it cooing harshly and chattering its mandibles together, at the same time jerking up its tail and erecting its crest. It is said that these birds become quite tame, and remain about gardens and yards, destroying mice, which they catch with as much dexterity as a Cat.

YELLOW-BILLED CUCKOO (*Coccygus americanus*).—The American Cuckoos are different from those of Europe, having lengthened, naked tarsi, instead of very short, feathered ones. The nostrils are elongated, instead of rounded, and the habits are entirely different. The American species rears its own young, instead of depositing its eggs in other birds' nests, like the bird of Europe. The Yellow-billed Cuckoo is distributed throughout North America, from Canada to Florida, and from the Atlantic Coast to California. In all the West India Islands it is common. Wilson says of this bird: "In marked contrast to the singularly unparental conduct of their European relatives, the American Cuckoos build their own nest, hatch their own eggs, and rear their own young," and that "in conjugal and parental affection they seem to be surpassed by no other birds." He adds: "They begin to pair early in May, and commence building about the 10th of that month. The nest is usually fixed among the horizontal branches of an apple tree; sometimes in a solitary thorn, crab or cedar, in some retired part of the woods. It is constructed with little art, and scarcely any concavity, of small sticks and twigs, intermixed with green weeds and blossoms of the maple. On this almost flat bed the eggs, usually three or four in number, are placed. These are of a uniform greenish-blue color, and of a size proportionate to that of the bird. While the female is sitting, the male is usually not far distant, and gives the alarm by his notes when any person is approaching. The female sits so close that you may almost reach her with your hand, and then precipitates herself to the ground, feigning lameness to draw you away from the spot; fluttering, trailing her wings, and tumbling over in the manner of the Woodcock and other birds. Both parents unite in providing food for their young. This consists chiefly of caterpillars, particularly such as infest apple trees."

MANGROVE CUCKOO (*C. minor*).—This is a West Indian species, but is occasionally seen in the Florida Keys. Audubon says it is a regular summer visitor to Key West and the Florida Reef.

BLACK-BILLED CUCKOO (*C. erythropthalmus*).—This is a familiar bird in the United States. It differs from the Yellow-billed in the black bill and in the absence of black on the tail feathers, the white tips of which are much shorter and less abruptly defined. The sexes are quite similar. The Black-bill is closely like the other species in most respects—in its habits, size and general appearance—and is found distributed over the same districts, but is not so numerous. Mr. Nuttall considers it less familiar than the other, building its nest in a more retired situation. In New England the Black-bill is quite abundant as a summer visitor.

THE ANI; THE SAVANNAH BLACKBIRD (*Crotophaga ani*).—This bird belongs to a genus the species of which are all American. They are all entirely black, the feathers of the neck and head having a peculiar stiffened, metallic or scale-like border. The species are not numerous, one only being found in the United States. It is not a resident, but is occasionally seen on the keys of the Florida

Reef. It is common in the West Indies and in South America as far south as Brazil. Gosse says: "It is abundant in Jamaica, and it was universally maintained by the inhabitants that these birds unite and build in company an immense nest of basket-work, made by the united labors of the flock, which is said to be placed on a high tree, where many parents bring forth and educate a common family." The bird is called the Black Witch in St. Croix—a name supposed to be due to its peculiar call-note, which sounds like *que-yuch!* They are seen hovering around cattle and horses, and alight on their bodies to pick up the ticks which infest those animals. They are often so intent upon securing food that they cling to the tails of cattle while they graze, and search the long hairs for insects.

FAMILY—PICIDÆ.

THE WOODPECKERS.

IVORY-BILLED WOODPECKER (*Campephilus principalis*).—Of the family *Picidæ*, more than one-half of the species belong to the New World. The present remarkable species is one of the forms which is confined to the extreme Southern States. It is not migratory, but resident where found. Audubon says of it: "The flight of this bird is graceful in the extreme, although seldom prolonged to more than a few hundred yards at a time, unless when it has to cross a large river, which it does in deep undulations, opening its wings at first to their full extent, and nearly closing them, to renew the propelling impulse. The transit from one tree to another—even should the distance be as much as an hundred yards—is performed by a single sweep, and the bird appears as if merely swinging itself from the top of the one tree to that of the other, forming an elegantly curved line. At this moment all the beauty of the plumage is exhibited, and strikes the beholder with pleasure. It never utters any sound while on the wing, unless during the love season; but at all other times, no sooner has this bird alighted than its remarkable voice is heard at almost every leap it makes, while ascending against the upper parts of the trunk of a tree or its highest branches. Its notes are clear, loud and yet rather plaintive. They are heard at considerable distance, perhaps half a mile, and resemble the false high note of a clarionet. They are usually repeated three times in succession, and may be represented by the monosyllable *pait, pait, pait.* These are heard so frequently, as to induce me to say that the bird spends few minutes of the day without uttering them, and this circumstance leads to its destruction. The hole which it bores for its nest is, I believe, always made in the trunk of a live tree, generally an ash or a hagberry, and is at great height. The birds pay great attention to the particular situation of the tree, selecting one that is inclined, so as to secure the nest against the access of water. They show forethought in selecting the space immediately under a branch or at the junction of the branch with the trunk. It is first bored horizontally for a few inches, then directly downwards. It is sometimes three feet in depth. The strength of this Woodpecker is so great that I have seen it detach pieces of bark seven or eight inches in length at a single blow of its powerful bill, and, by beginning at the top branch of a dead tree, tear off the bark to the extent of twenty or thirty feet in the course of a few hours, leaping downwards, with its body in an upward position, tossing its head to the right and left, or leaning it against the bark to ascertain the precise spot where the grubs were concealed, and immediately after renewing its blows with fresh vigor, all the while sounding its loud notes, as if highly delighted." The Ivory-bill is a large bird, being twenty-one inches in length, the wing ten inches. Wilson says of him: "This majestic and formidable species in strength and magnitude stands at the head of the whole class of Woodpeckers hitherto discovered. He may be called the chief of his tribe, and nature seems to have designed him a distinguished characteristic in the superb carmine crest and bill of polished ivory, with which she has ornamented him. His eye is brilliant and daring, and his whole frame so admirably adapted for his mode of life and method of procuring subsistence, as to impress on the mind of the examiner the most reverential ideas of the Creator. His manners have, also, a dignity in them superior to the common herd of Woodpeckers." The cry of this bird is like that of a hurt child. Wilson gives an amusing account of one that he had wounded, and was conveying upon his horse to Wilmington. His horse became frightened, and the inhabitants came forth to see what produced such human-like cries.

HAIRY WOODPECKER (*Picus villosus*).—This is a common visitor in New England in the spring, fall and winter months, and is to some extent a resident through the year. It is found as far west as the eastern base of the Rocky Mountains, and northward to British Columbia and Sitka. It is also accidental in England. It is less wild and more domestic than any other species, and is a familiar resident in our orchards during the breeding season. It has a strong, shrill and tremulous cry, and also a single note, or *chuck*, which it often repeats in an eager manner, as it hops about and digs into the crevices of the trees. The Hairy Woodpecker is nine inches in length, and fifteen in extent of wing. Its flight is, like some other species, a curious rising and sinking alternately. The feet are very powerful, made to grip strongly the bark of the trees on which it searches for insect food. Instances have occurred where the bird remained with its claws deeply inserted in the trunk of a tree long after its death.

HARRIS' WOODPECKER (*P. villosus; var. harrisi*) is a western bird, found south as far as Central America. It was first described by Audubon, and is considered to be only a variety of the preceding.

DOWNY WOODPECKER (*P. pubescens*).—Called also the LESSER SAPSUCKER. Like the Hairy Woodpecker, it is a resident wherever it is found, and not migratory. Its habitat is through Eastern United States to the eastern slope of the Rocky Mountains, and north into British Columbia. The nest

is cut in solid wood, and is described by Wilson as being as regular as if marked by a pair of compasses. During the labor of constructing the nest, they regularly carry out the chips, often strewing them at a distance, to prevent suspicion. The House Wren, who has the power to construct its own nest, is known to take advantage of the little Woodpecker, and when the excavation is completed, meanly usurps the cosy domicile and drives away its rightful owner. He has a single note, or *chuck*, which, like the former species, he frequently repeats; and when he flies off to another tree, utters a rather shriller cry, composed of the same note, frequently repeated. This is the smallest of our Woodpeckers, being only six inches and three-quarters in length.

GAIRDNER'S WOODPECKER (*P. pubescens; var. gairdneri*).—This is a variety of the preceding, found only on the western portion of the continent. It is similar to pubescens in size and markings, but with less white on the wings.

LADDER-BACKED WOODPECKER (*P. scalaris*) is found in Mexico and Guatemala, and adjacent parts of the United States, and is one of the smallest of the North American species. Its habits are much the same as those of the other varieties.

THE CAPE WOODPECKER (*P. scalaris; var. lucasanus*).—In this variety there is a general appearance to P. nuttali and scalaris, but the bill and feet are much larger, and some difference of marking is observable. Habitat, Cape St. Lucas.

NUTTALL'S WOODPECKER (*P. nuttalli*).—Inhabiting the coast region of California, and first discovered by Dr. Gambel near Los Angeles, Cal. Mr. Ridgway describes its notes as very peculiar, the usual one being a prolonged, querulous, rattling call, unlike that of any other bird known to him. Its length is seven inches; wing, four and a half.

RED-COCKADED WOODPECKER (*P. borealis*).—This bird is southern in its habitat, and is rarely seen as far north as Pennsylvania. It is quite restricted to the south-eastern portion of the United States, and has been seen as far west as Eastern Texas. Stragglers have been found farther north. Mr. Lawrence obtained a specimen in Hoboken, N. J. This species is said to be particularly agile. Audubon says: "It glides upwards and sideways along the trunks and branches, on the lower as well as the upper sides of the latter, moving with great celerity, and occasionally uttering a short, shrill, clear cry, that can be heard at considerable distance." Length of body seven inches and a quarter; wing, four and a half.

WHITE-HEADED WOODPECKER (*P. albolarvatus*).—This species was first discovered by Mr. John G. Bell, in the vicinity of Sutter's Mills, in California. He says it frequents the higher branches of the pines, keeping almost out of gun-shot range. Active and restless in its movements, it utters at rare intervals a sharp and clear note, while busily pursuing its search for food. Its habits and manners are the same as those of the P. harrisi, but it is of a livelier and more restless disposition. Its white head and primaries render it easily distinguishable. Length about nine inches; wing, five and a quarter.

BLACK-BACKED THREE-TOED WOODPECKER (*Picoides arcticus*).—This differs from other American Woodpeckers in having the back entirely black. Its range of habitat is from the Atlantic to the Pacific, and from the northern portion of the United States to the Arctic regions. Audubon says it occurs in Northern Massachusetts, and in all portions of Maine that are covered by forests of tall trees, where it constantly resides. Dr. Cooper speaks of it as a very silent bird; the only note he heard being a shrill, harsh, rattling cry, quite distinct from that of any other Woodpecker. Prof. Verrill says this bird is very common in Western Maine in the spring, fall and winter, but is not found there in the summer.

WHITE-BACKED THREE-TOED WOODPECKER (*Picoides tridactylus; var. americanus*)—Plate 16, fig. 58—is not a common bird in any part of America. It is mostly confined to the Arctic regions, coming south as far as the States in winter. In habits it is said to resemble the Hairy Woodpecker.

YELLOW-BELLIED WOODPECKER (*Sphyropicus varius*) is found throughout the United States. It is very irregularly distributed in New England. Verrill says it is a common summer visitor, and breeds at Norway, Me. On the seaboard it is considered rare. It prefers the woods to more open places, and is not seen in the orchards, as is the Hairy Woodpecker and others. This bird, like other species, has a habit of picking holes in sound trees, where no signs of insects appear. "What their object is," says Dr. Bryant, "has not been satisfactorily settled. In Massachusetts, I am not aware that these holes are ever sufficiently large or numerous to cause any material injury to the apple trees. They are generally seen in circles around the limbs and trunks, and in this vicinity are almost exclusively made by the Downy Woodpecker, aided occasionally by the Hairy Woodpecker."

RED-NAPED WOODPECKER (*S. varius; var. nuchalis*).—This variety is very constant in its markings, and is considered to be a distinct species. It is confined to the middle province of the United States; found in Arizona and vicinity of Fort Mohave. Two specimens have been taken in New England, but were undoubtedly stragglers. Its notes, habits and manners are like those of the S. varius.

WILLIAMSON'S WOODPECKER (*S. williamsoni*).—The range of this species is from the Rocky Mountains to the Cascade Mountains, Sierra Nevada. It was first discovered by Dr. Newberry, in the pine forest of Upper Klamath Lake. Its habits and notes are similar to those of P. harrisi.

BROWN-HEADED WOODPECKER (*S. thyroideus*).—Habitat, the cascade and coast ranges of California and Oregon, Sierra Nevada, Wahsatch and Rocky Mountains. This is regarded as a very rare species. It was first met with by Mr. J. G. Bell, in the lower Sierra Nevada. Its manners and note are like those of the preceding species.

BLACK WOODCOCK; LOG-COCK (*Hylatomus pileatus*).—This is a large species, measuring eighteen inches in length, and having the wing nine and a half inches long. It extends over the wooded portions

of North America, from the Atlantic to the Pacific. It is a resident of the northern districts of New England throughout the year, and has been known to breed as far south as Massachusetts. Verrill says it is most common in winter. This bird is the second in size among his tribe. Wilson says: "He is noted for making a loud and almost incessant cackling before wet weather, flying at such times in a restless, uneasy manner from tree to tree, making the woods echo to his outcry. Almost every old trunk in the forest where he resides bears the mark of his chisel. Whenever he perceives a tree beginning to decay, he examines it around with great skill and dexterity, strips off the bark in sheets of five or six feet in length, to get at the hidden cause of the disease, and labors with a gayety and activity really surprising." The Pileated Woodpecker is not migratory, but braves the extremes of both the arctic and torrid regions. Neither is he gregarious, for it is rare to see more than one or two, or at the most three, in company. Dr. Brewer says: "I have occasionally met with it in the wilder portions of New Hampshire and Maine, but have nowhere been so fortunate as to observe its nest or breeding-place. It has always seemed a very shy bird, difficult of approach, always keeping at a safe distance, and ever greeting your attempts for a nearer view with a loud, cackling cry, not unlike a derisive laugh. The nest of this species is dug out of a tree by themselves, and has no lining but the rotten chips that are allowed to remain in the bottom of the hole." Mr. Paine, of Randolph, Vt., says that they were very abundant in that State fifty years since, but are now extremely rare. They are quite numerous in Texas, and have been met with in Vancouver Island. Specimens from the Northern Rocky Mountains and from the region of Puget's Sound are much larger than those from the South, and approach very nearly the great Ivory-bill Woodpecker in size.

RED-BELLIED WOODPECKER (*Centurus carolinus*).—This species has all the restlessness and the noisy habits of its tribe. It is less domestic than some, and more solitary, preferring the largest high-timbered woods and tallest decayed trees of the forest. It inhabits a large extent of country, from the Atlantic Coast to the eastern slope of the Rocky Mountains, in all of which it seems to be resident. It is much more abundant in the southern and western States, and is very rarely found north of Pennsylvania on the Atlantic Coast, though it is, according to Wilson, abundant in Upper Canada. Mr. Allen speaks of it as a summer visitant in Western Massachusetts, and Prof. Emmons has taken it in Connecticut.

YELLOW-BELLIED WOODPECKER (*C. aurifrons*).—This is exclusively a southern bird, its habitat being on the Rio Grande region and Mexico. It is regarded as very shy, and as frequenting very commonly the trunks of the mesquiti, uttering a loud, sharp cry as it passes from one tree to another. This is an interesting instance of the preference which birds often give to certain kinds of trees or shrubs. Dr. Heerman, who has been familiar with this species, says that he never found them in any other tree.

GILA WOODPECKER (*C. uropygialis*).—This species was discovered by Dr. Kennerley in his route along the thirty-fifth parallel, and described by Prof. Baird in 1854. It is very shy, and seems to have very peculiar notes, which it utters when flying, as do others of the class. The giant cactus, of the Mexican plains, is seen bored by this bird, and its nest is frequently constructed in the pithy interior of the larger stalks. They subsist mostly on insects, but they also feed on the berries of the mistletoe and mesquiti. Dr. Cooper says: "They have a loud note of alarm, strikingly similar to that of the Phænopepla nitens, which associates with them in the mistletoe boughs."

LEWIS' WOODPECKER (*Melanerpes torquatus*).—This species is found from the Black Hills to the Pacific, and reaching from Puget's Sound to the gulf of California. They were first observed by Lewis and Clarke in their journey to the Pacific. Mr. Nuttall, who met with them in the central chain of the Rocky Mountains, describes them as very unlike Woodpeckers in their habits, as they perched in dense flocks, like Starlings, neither climbing branches, nor tapping in the manner of their tribe, but darting after insects, and devouring berries like Thrushes. Their breeding places are generally holes in oaks and other trees, which are excavated for the purpose. All observers agree in stating that the habits are singularly different from others of the tribe. Mr. Lord says: "It flies with a heavy flapping motion, much like a Jay, feeds a good deal on the ground, and chases insects on the wing, like a Shrike or a King-bird." Whilst mating, they assemble in large numbers, and keep up a continual, loud, chattering noise. It approaches nearer to the Red-headed Woodpecker in its habits, but has many distinctive peculiarities. Mr. Ridgway found it very abundant in Sacramento Valley, and noticed a very peculiar and characteristic habit of ascending high into the air, and taking a strange, floating flight, seemingly laborious, as if struggling against the wind, and then descending in broad circles to the trees.

RED-HEADED WOODPECKER (*Melanerpes erythrocephalus*).—This is one of the most universally known birds in the United States. Its strikingly beautiful plumage, and sharp contrasts of brilliant color render it particularly attractive. In New England it is not so common, though it is found, even in winter, in most of the States. Dr. Brewer says that it was once common in the neighborhood of Boston, but is now seldom met with. Mr. Paine, of Vermont, says that it is a tradition among his neighbors that this bird was formerly everywhere known throughout all portions of the State. It has the reputation of being fonder of small fruits than any other species. Of this habit Wilson says: "But let us not condemn the bird unheard; they exist, they must therefore be necessary. If their merits and usefulness be found, on examination, to preponderate against their vices, let us avail ourselves of the former, while we guard as well as we can against the latter. Though this bird occasionally regales himself with fruit, yet his natural and most useful food

is insects, particularly those numerous and destructive species that penetrate the bark and body of the tree to deposit their eggs and larvæ, the latter of which are well known to make immense havoc. Insects form at least two-thirds of his subsistence; and his stomach is scarcely ever found without them. He searches for them with a dexterity and intelligence, I may safely say, more than human; he perceives by the exterior appearance of the bark where they lurk below. When he is dubious, he rattles vehemently on the outside with his bill, and his acute ear distinguishes the terrified vermin shrinking within to their utmost retreats, where his pointed and barbed tongue soon reaches them. The masses of bugs, caterpillars, and other larvæ, which I have taken from the stomachs of these birds, have often surprised me."

CALIFORNIA WOODPECKER (*Melanerpes formicivorus*).—Confined to the Pacific Coast region of the United States and Northern Mexico. "A striking characteristic of this bird," says Dr. Coues, "is the extraordinary differences in the color of the iris, which varies from white to red, blue, yellow, ochraceous or brown." Dr. Heerman describes this as one of the noisiest, as well as the most abundant, of the Woodpeckers of California. He speaks of it as catching insects on the wing, after the manner of a Fly-catcher, and mentions its very extraordinary habit of digging small holes in the bark of the pine and the oak, in which it stores acorns for its food in winter. One of these acorns is placed in each hole, and is so tightly fitted in, that it is with difficulty extracted. The bark of a large pine will present the appearance of being closely studded with brass nails, the heads only being visible. Saussure speaks of a species of Woodpecker, which he supposes to be Colaptes mexicanoides, storing up acorns in the hollow stems of the maguey plants. The birds were seen to fly at first to the stalks of the maguey, and to attack them with their beaks, and then pass to the yuccas, and there repeat their labors. These stalks, upon examination, were all found to be riddled with holes, placed irregularly one above another, and communicating with the hollow cavity within. On cutting open one of these stalks, he found it filled with acorns. The central cavity is only large enough to receive one acorn at a time. They are packed in, one above the other, until the cavity is filled. The intelligent instinct that enables this bird to solve the problem of using these storehouses, Saussure regarded as not the least surprising feature. It pierces the stalk low down, and introduces the acorns until the cavity is filled; it then bores another hole just above, in the next joint, and so continues until the stalk is quite loaded. Mount Pizarro, where this habit was observed, is in the midst of a barren desert of sand and volcanic *débris*. There are no oak trees nearer than the Cordilleras, thirty miles distant, and therefore the collecting and storing of each acorn required a flight of sixty miles. "This is obviously an instinctive preparation," says Saussure, "on the part of these birds, to provide the means of supporting life during the arid winter months, when no rain falls, and everything is parched." His observations were made in April, the last of the winter months, and he found the Woodpeckers withdrawing food from their depositories, and satisfied himself that the birds were eating the acorn itself, and not diminutive maggots a few of them contained. Dr. Brewer, in commenting on this curious habit (*North American Birds, vol. ii., p.* 570), says: "There are several remarkable features to be noticed in the facts observed by Saussure—the provident instinct which prompts this bird to lay by stores of provisions for the winter; the great distance traversed to collect a kind of food so unusual for its race; and its seeking, in a spot so remote from its natural abode, a storehouse so remarkable. Can instinct alone teach, or have experience and reason taught these birds that, better far than the bark of trees, or cracks in rocks, or cavities dug in the earth, or any other known hiding-place, are these hidden cavities within the hollow stems of distant plants? What first taught them how to break through the flinty coverings of these retreats? By what revelation could these birds have been informed that within these dry and closed stalks they could, by searching, find suitable places, protected from moisture, for preserving their stores in a state most favorable for their long preservation, safe from gnawing rats and from those acorn-eating birds whose bills are not strong or sharp enough to cut through their tough enclosures?" M. Sumichrast, who enjoyed excellent opportunities for observing these birds, states that they also pierce the oak trees and deposit the acorns within the holes thus made, driving them forcibly into the cavity. Several very large and interesting specimens of oak, from California, quite filled with acorns, are in the American Museum, New York.

THE NARROW-FRONTED WOODPECKER (*Melanerpes formicivorus; var. augustifrons*).—This is a variety of the last-mentioned species, found at Cape St. Lucas by Mr. John Xantus. It is smaller, and has different markings, which are found to be constant.

FLICKER (*Colaptes auratus*).—This elegant bird is a very common summer inhabitant in New England, where it is called GOLDEN-WINGED WOODPECKER. It is also named, in other parts of the country, HIGH-HOLDER, PIGEON WOODPECKER, etc. It inhabits all of Eastern North America to the eastern slope of the Rocky Mountains. It is the most abundant of all the Woodpeckers in New England, and is found throughout the whole year in the southern part. In Massachusetts it is often met with in midwinter, even when the season is severe. Audubon gives a pleasant account of its habits: "Their note is merriment itself, as it imitates a prolonged and jovial laugh heard at considerable distance. Several males pursue a female, reach her, and, to prove the force and truth of their love, bow their heads, spread their tails, and move sidewise, backwards and forwards, performing such antics as might induce any one witnessing them, if not of a most morose temper, to join his laugh to theirs. The female flies to another tree, where she is closely followed by one, two, or even a half a dozen of these gay suitors, and where

again the same ceremonies are gone through. No fightings occur; no jealousies seem to exist among these beaux, until a marked preference is shown to some individual, when the rejected proceed in search of another female. In this manner all the Golden-winged Woodpeckers are soon happily mated. Each pair immediately proceeds to excavate the trunk of a tree, and finish a hole in it sufficient to contain themselves and young. They both work with great industry and apparent pleasure. The hole is often twenty inches in depth, and is not unfrequently in the solid wood. Though they are provided with stout, sharp bills, it is difficult to realize the fact that such wonderful work can be accomplished by them." Wilson mentions a feat which shows remarkable sagacity in this bird. He has known it to detect the hollow of a limb under the solid and sound exterior, and pierce it for the purpose of building its nest there.

RED-SHAFTED WOODPECKER (*C. mexicanus*).—This bird, closely resembling the last-named, is confined to the Pacific Coast. Dr. Newberry found it abundant in California and Oregon, and considers it as resembling the Golden Flicker in its habits, but is much shyer. Dr. Cones states that its tongue is capable of protrusion to an extent far beyond that of any other North American Woodpecker.

HYBRID FLICKER (*C. hybridus*).—This is found on the Upper Missouri and the Yellowstone, and in the Black Hills. It is considered a hybrid, resulting from the breeding of two different species.

THE CAPE FLICKER (*C. chrysoides*).—Found on the Colorado and Gila Rivers, and as far south as Cape St. Lucas. It is considered as intermediate between the C. auratus and mexicanus, and has the same habits, flight and cries as the latter. It appears to be migratory, and comes from the south. The eggs are like those of mexicanus.

Family—PSITTACIDÆ.

The Parrots.

Of the few species of the Parrot family represented in the New World, one of the sub-family *Psittacinæ* is found in the United States. Of the genus Psittace, which embraces eighteen species, two come sufficiently near to the southern borders of the United States to render it possible that they may yet be found to cross the border. Audubon shot, on the Rio Grande of Texas, the S. pachyrhyncha, and the S. militaris is common at Mazatlan.

PARAKEET; CAROLINA PARROT (*Conurus carolinensis*).—The habitat of this bird is the Southern and South-western States, and Mississippi Valley. It was once very abundant in the United States, east of the Rocky Mountains, even as far as Pennsylvania. In Florida they are yet abundant. Wilson says: "At Big Bone Lick, thirty miles above the mouth of the Kentucky River, I saw them in great numbers. They came screaming through the woods in the morning, about an hour after sunrise, to drink the salt water, of which they, as well as the pigeons, are remarkably fond. When they alighted on the ground, it appeared at a distance as if covered with a carpet of the richest green, orange and yellow; they afterwards settled in one body on a neighboring tree, which stood detached from any other, covering almost every twig of it, and the sun, shining strongly on their gay plumage, produced a very beautiful and splendid appearance. Here I had an opportunity of observing some very peculiar traits of their character. Having shot down a number, some of them were only wounded. The whole flock swept repeatedly around their prostrate companions, and again settled on a low tree, within twenty yards of the spot where I stood. At each successive discharge, though showers of them fell, yet the affection of the survivors seemed rather to increase; for after a few circuits around the place, they again alighted near me, looking down on their slaughtered companions with such manifest symptoms of sympathy and concern as entirely disarmed me. They fly very much like the Wild Pigeon, in close, compact bodies, and with great rapidity, making a loud and outrageous screaming, not unlike that of the Red-headed Woodpecker." This bird is sometimes called the Illinois Parrot. It is thirteen inches long, and twenty-one in extent of wings. The species seems to be the only one that is found so far North. Wilson speaks of seeing them in the month of February along the banks of the Ohio, in a snow storm, flying about like Pigeons, and in full cry. Their food is usually nuts and seeds; the cockle burr being a favorite item.

Family—STRIGIDÆ.

The Owls.

AMERICAN BARN OWL (*Strix flammea*).—This Owl is common to the more southern portion of North America, especially near the sea-coast, in Mexico and California. It is very rarely seen north of Pennsylvania, though it has been found, as a straggler, in New England. Dr. Heerman speaks of it as very abundant in California before the settlement by eastern immigration. These birds are still abundant in the old Catholic missions, where they frequent the ruined walls and towers, and construct their nests in the crevices and nooks of those once stately buildings, now fallen to decay. These ruins are also a shelter for innumerable bats, reptiles and vermin, which form an additional attraction to the Owls. A favorite morsel of food of the Barn Owl is the meadow mouse; and the bats also constitute an important item in its diet. The female is fifteen and a half inches in length, and three feet eight inches in extent of wing. S. furcata, a species found in the West Indies, is hardly distinguishable from the present one, and its habits are supposed to be the same.

LONG-EARED OWL (*Otus vulgaris*)—Plate 4, fig. 10.—This is a common species in New England, and is found pretty equally distributed over the whole of temperate North America. It is entirely nocturnal in its habits, and is considered to have less power of vision by day than any other species. It is the most numerous of any other American species. Except in size, it has more resemblance to the Great

horned Owl than any other of its tribe, breeding like it among the branches of tall trees. It is fourteen inches and a half long, and three feet two inches in extent of wing. The "ears" are large, and composed of six feathers, gradually lengthening from the front one backwards, black, edged with rusty-yellow. This bird is closely allied to the Otus vulgaris of Europe; the present species being regarded as a variety, and called wilsonianus. It has the habit of using the nests of other birds, though sometimes it constructs one for itself. Mr. Ridgway found it very abundant in the Sacramento Valley, and noticed that it generally laid its eggs in the deserted nests of the Magpie.

SHORT-EARED OWL (*Otus brachyotus*).—This is also called the MARSH OWL. It is not common in any part of New England, excepting the sea coast, although its habitat is regarded as covering "the entire continent and adjacent islands of America, also Europe, Asia, Africa, Polynesia and Sandwich Islands. In the geographical variations of this species, it is seen that the average plumage of North American specimens is just appreciably darker than that of the European, while tropical specimens have a tendency to be still darker. I know of no bird so widely distributed which varies so little in the different parts of its habitat, unless it be the Cotyle riparia, which, however, is not found so far south."—*Baird.* Dr. Newberry met with this bird in Oregon and California, finding it especially common in the Klamath Basin. Though properly nocturnal, it was met with, hunting on cloudy days, flying low over the meadows, in the manner of and associated with the Marsh Hawk. Its length is fifteen inches; extent of wing three feet four inches.

GREAT GRAY OWL (*Syrnium cinereum*).—This is a denizen of the Arctic regions of America, and is possibly a resident in Canada. In winter it extends occasionally as far south as Massachusetts. It is said to hunt by daylight in the more northern regions, and to prefer the wooded districts. A fine specimen was captured in Marblehead, Mass., and is now in the collection of the Essex Institute. Another, shot in Lynn, is in the collection of W. S. Brewer, of Boston. This is the largest Owl of North America. Its head is very large; eyes, small; tail rather long, upper parts smoky or ashy-brown, mottled and transversely barred with ashy-white. Its total length is twenty-five to thirty inches; wing, eighteen; tail, twelve to fifteen. Audubon says of this species: "The comparatively small size of this bird's eyes renders it probable that it hunts by day; and the remarkable smallness of its feet induces me to think that it does not prey upon large animals. It is common on the borders of the Great Bear Lake; and there, in the higher parallels of latitude, it must pursue its prey during the summer months by daylight. It keeps, however, within the woods, and does not frequent the barren grounds, like the Snowy Owl; nor is it so often met with in broad daylight as the Hawk Owl, but hunts principally when the sun is low. Indeed, it is only at such times, when the recesses of the woods are deeply shadowed, that the American Hare and the murine animals, on which this Owl chiefly preys, come forth to feed."

BARRED OWL (*Syrnium nebulosum*).—This is a much smaller species of the same genus as the preceding, and has the same peculiar, soft, cinereous plumage. It is common in New England, and extends over Eastern North America and west to the Missouri; south to the Rio Grande. It is remarkable for its soft and rapid flight, the great breadth of wings giving it extraordinary power. Its vision is said to be almost as good in the daylight as in the night. The Barred Owl is most abundant in the Southern States, where it is called the Hoot Owl. It is not found on the Pacific Coast, nor in the high northern latitudes; but in all parts of the United States it is probably a more familiar Owl than either of the other native species. "How often," says Audubon, "when snugly settled under the boughs of my temporary encampment, and preparing to roast a venison steak or the body of a squirrel on a wooden spit, have I been saluted with the exulting bursts of this nightly disturber of the peace, that, had it not been for him, would have prevailed around me as well as in my lonely retreat! How often have I seen this nocturnal marauder alight within a few yards of me, exposing his whole body to the glare of my fire, and eye me in such a curious manner, that, had it been reasonable to do so, I would have invited him to walk in and join me in my repast! The liveliness of his motions, joined to their oddness, have often made me think that his society would be at least as agreeable as that of many of the buffoons we meet with in the world. Should the weather be lowering and indicative of the approach of rain, their cries are so multiplied during the day, and especially in the evening, and they respond to each other in tones so strange, that one might imagine some extraordinary *fête* about to take place among them. On approaching one of them, its gesticulations are seen to be of a very extraordinary nature. The position of the bird, which is generally erect, is immediately changed. It lowers its head and inclines its body to watch the motions of the person beneath; throws forward the lateral feathers of its head, which thus has the appearance of being surrounded by a broad ruff; looks towards him as if half blind, and moves its head to and fro in such an extraordinary manner as almost to induce a person to fancy that part dislocated from the body." Wilson says: "The difference in size between the male and female of this species is extraordinary, sometimes amounting to nearly eight inches in the length." The male measures sixteen inches and a half in length, and thirty-eight inches in extent. As is common with this group, the female is much the larger.

WESTERN BARRED OWL (*Syrnium occidentale*).—This is a very closely allied species, called also the SPOTTED OWL. It was first described by Mr. Xantus, in *Proceedings of Acad. Nat. Sciences, Phila.*, in 1859. Its habitat is given as follows: Southern Middle Province of United States (Fort Tejon, California, and Tucson, Arizona). Nothing is recorded concerning its habits.

THE SPARROW OWL (*Nyctale richardsoni*).—This is an exceedingly rare bird in New England, being confined mostly to the extreme northern portions of North America. Specimens have been taken in various parts of Massachusetts. It is common at Hudson's Bay. It is nearly related to the N. funerea of Europe, both having been recorded under one name by some authors. Its length is about ten and a half inches.

SAW-WHET OWL (*Nyctale acadica*), called also the ACADIAN OWL.—This is rare in New England, though found occasionally in the summer months. Audubon says of it: "The sound of its love notes bears a great resemblance to the noise produced by filing the teeth of a large saw. These notes when coming, as they frequently do, from the interior of a deep forest, produce a very peculiar effect upon the traveler, who, not being aware of their real nature, expects, as he advances on his route, to meet with shelter under a saw-mill at no great distance." This Owl is also called the White-fronted and Kirtland's Owl. Audubon gives an account of the singular ventriloquial powers of this bird. On one occasion he heard what seemed to him to be the faint notes of a distant bell. Upon approaching the place from which the sounds proceeded, they appeared at one time to be in front of him, then behind him, now on his right hand, now on his left, again at a great distance, and then close behind him. At last he discovered the bird at the entrance of a small hole in a birch tree, where it was calling to its mate. As he stood at the foot of the tree, in full sight of the bird, he observed the singular power it possessed of altering its voice, making it seem near or remote—a faculty which he had never seen in any other bird.

LITTLE RED OWL (*Scops asio*), also called the MOTTLED OWL and SCREECH OWL.—Several varieties of this bird are recorded by Prof. Baird in the *North American Birds*, under separate heads. Scops asio, var. floridana, is an extreme southern form, and is much smaller than the northern ones. S. asio, var. maccali, Western Mottled Owl, is found in Lower and Southern California. S. asio, var. kennicotti, is from the north-western corner of North America. It is a very dark variety, and differs in its markings somewhat from the asio. The Mottled Owl is wholly a nocturnal bird. "During the night it utters a very peculiar wailing cry, not unlike the half-whining, half-barking complaints of a young puppy; alternating from high to low, intermingled with deep gutteral trills. Its flight is noiseless and gliding, and it moves in a manner so nearly silent as to be hardly perceptible. It can hardly be said to construct any nest, but lines the hollow in which it rears its young with a few loose leaves, dry grasses and feathers. The eggs are usually five or six in number, pure white, and nearly round."—*Brewer*.

FEILNER'S OWL (*S. flammeola*).—This bird is found in Guatemala and Central Mexico, and in California. It is named after Capt. John Feilner, who obtained a specimen at Fort Crook, in California, thus introducing it to our Fauna. Its habits are supposed to be the same as those of S. asio.

GREAT-HORNED OWL (*Bubo virginianus*).—This species inhabits Eastern North America, south of Labrador, west to the Missouri, and south through the Atlantic region to Mexico. Three varieties are recorded. B. virginianus, var. arcticus, or Western Great-horned Owl, is of lighter color. It is found in the western region of North America, from the interior Arctic districts to the Table-lands of Mexico. B. virginianus, var. pacificus, is found on the Pacific Coast. "The Great-horned Owl has an extended distribution throughout at least the whole of North America, from ocean to ocean, and from Central America to the Arctic regions. Throughout this widely extended area it is everywhere more or less abundant, except where it has been driven out by the increase of population. In this wide distribution the species naturally assumes varying forms, and exhibits considerable diversities of coloring. These are provided with distinctive names to mark the races, but should all be regarded as belonging to one species, as they do not present any distinctive variation in habit."—*Brewer, N. A. Birds.* The Great-horned Owl is resident in all the New England States throughout the year. Wilson says: "His favorite residence is in the deep solitudes of swamps, covered with a growth of gigantic timber; and here, as soon as evening draws on, and mankind retire to rest, he sends forth such sounds as seem scarcely to belong to this world, startling the solitary pilgrim as he slumbers by the forest-fire, making night hideous. Along the mountainous shores of the Ohio, and amidst the deep forests of Indiana, alone, and reposing in the woods, this ghastly watchman has frequently warned me of the approach of morning, and amused me with his singular exclamations, sometimes sweeping down and around my fire, uttering a loud and sudden *Waugh O! Waugh O!* sufficient to have alarmed a whole garrison." The length of the male is twenty inches; the female is about twenty-four inches.

SNOWY OWL (*Nyctea nivea*)—Plate 4, fig. 12.—This is a very common winter visitor on the New England Coast. It is found in the northern regions of both continents; migrating southward in winter. In Canada it is resident, where it breeds, making its nest upon the ground. It feeds on the dead fish that are thrown up by the tides, and is known to feed on carrion at times. In Southern New England the Snowy Owl is generally seen more abundant when a severe and protracted snow-storm has prevailed; at such times this bird is no doubt driven to eat the refuse of the beaches and open places, as is the case with the Common Crow. This Owl hunts equally well in the daylight and twilight, but prefers the dull, gloomy days. Audubon says that it captures fishes by standing quietly by the margin of a pool and seizing them in its claws. Wilson says of it: "The color of this bird is well suited for concealment while roaming over the general waste of snow; and its flight, strong and swift, very similar to that of some of our large Hawks. Its hearing must be exquisite, if we judge from the largeness of these organs in it; and its voice is so dismal that, as Pennant observes, it adds horror

even to the regions of Greenland by its hideous cries, resembling those of a man in deep distress." The male measures twenty-two inches in length, and four feet six inches in extent of wing. The female is considerably larger, as is the case with all birds of this order. The Snowy Owl is a remarkably handsome bird, its plumage being in some instances nearly pure white. The large, round, orange-colored eyeballs give great brilliancy, and shine like the richest gems in their pure white setting. Some individuals are handsomely mottled with black, and have transverse bars of black across the breast. The American Snowy Owls are somewhat darker than those of Europe. The dusky bars of the plumage are darker and broader.

HAWK OWL (*Surnia ulula*).—This bird is occasionally met with in some parts of New England. It is found in the northern regions of both continents, being rarely seen as far south as Pennsylvania. It partakes of the general appearance and habits of both an Owl and a Falcon. Unlike the Owls, it is almost wholly diurnal in its habits; and, for this reason, it has obtained the trivial name of Day Owl. The Hawk Owl occasionally breeds in New England. Mr. Boardman has found its nest, with eggs, in the neighborhood of Milltown, in Maine. So complete is the resemblance to both Hawk and Owl, one would naturally suppose that this bird is the result of a cross; yet it is as distinct, independent, and original a species as any other. It is regarded as very bold and active; frequently it has been seen to follow the game as it drops to the ground from the sportsman's shot, and to seize and bear it away. The male of this species is fifteen inches long. Though so small, it boldly attacks the Ptarmigan, and succeeds in carrying it off.

CALIFORNIA PIGMY OWL (*Glaucidium passerinum*).—This bird is found in the Pacific Province of North America, from Vancouver's Island southward, and from the Rocky Mountains to the Pacific. It is quite closely related to the G. passerinum of Europe. It is one of the smallest of our North American Owls. In habit it is somewhat diurnal, and its notes, quite unlike those of other species, are said to be "subdued, clear, and like the soft, low notes of a flute."

RED-TAILED OWL (*Glaucidium ferrugineum*).—The habitat of this Owl is the whole of Eastern South America and Middle America (both coasts), and north into the southern border of the United States, as far as Arizona. "This little Owl claims a place in our Fauna on the strength of several specimens taken in Southern Arizona by Captain Bendire. It is a southern bird, found throughout the whole of Mexico, and ranges thence through the whole of South America, except the Pacific Coast, as far south as Southern Brazil. In Mexico it is as abundant on the Pacific as on the eastern coast, and is by far the most common Owl of its genus found in that country. Mr. E. C. Taylor states that he found this pretty bird common in Trinidad, where it is said to fly about in the daytime, apparently indifferent to the blazing sun, and is much smaller than any other species of Owl he met with."—*North American Birds.*

WHITNEY'S OWL (*Micranthe whitneyii*).—"This well-marked genus is represented by a single species, found in the Colorado region of the United States, and in Western Mexico. It is the smallest of all known Owls, and has the general aspect of the Glaucidium. Its length is six inches and a quarter, and extent of wing fifteen and a quarter."—*N. A. Birds.*

BURROWING OWL (*Spheotyto cunicularia*).—This Owl is of a genus peculiar to America, where it is distributed over the whole of the southern and western half of the northern continent, as well as in some of the West India Islands. There is certainly but one species, or even race, of Burrowing Owl in North America. The South American bird is not considered specifically distinct. Burrowing Owls are very abundant, congregating together in large communities, and differing from most members of their family by living and breeding in burrows in the ground. Thomas Say was the first American naturalist who met with this bird. While with Col. Long's expedition he encountered it, and describes it as residing exclusively in the villages of the Prairie-dog, whose excavations are so commodious as to make it unnecessary for the bird to dig for itself, which it is able to do when occasion requires. These villages are very numerous and variable in their extent, sometimes covering only a few acres, and at others spreading over the surface of the country for miles together. They are composed of slightly elevated mounds, having the form of a truncated cone, about two feet in width at base, and seldom rising as high as eighteen inches above the surface. The entrance is at the top or on the side. From the entrance the passage descends vertically one or two feet, and thence it continues obliquely downward until it terminates in the snug apartment where these animals enjoy their winter's sleep, and where they and the Owls are common, but unfriendly occupants. This Owl is strictly of diurnal habits, and feeds principally on insects—the large beetles, grasshoppers and larvæ. Dr. Kennedy says: "When molested they commence bowing and chattering in a somewhat ludicrous manner at the intruder, or fly swiftly away, keeping near the earth, and alighting suddenly in the vicinity of a burrow to renew these amusing motions." Mr. Darwin speaks of the South American variety as preying on mice and reptiles, and adds that they usually dig their own burrows.

FAMILY—FALCONIDÆ.

THE FALCONS.

"The characters of this family are: Eyes directed laterally, and eyelids provided with lashes; toes invariably naked, and tarsus usually naked and sentellate (feathered only in Aquilla and Archibutes); outer toe not reversible (except in Pandion); head never with ear-tufts, and never wholly naked (except in the *Vulturinæ* of the Old World). The above characters are about the only readily observable points in the external anatomy in which the *Falconidæ*

differ strikingly from the *Strigidæ*, *Cathartidæ*, and may serve to distinguish the birds of this family from those of the two others."—*N. A. Birds.*

WHITE GERFALCON (*Falco gyrfalco*).—The habitat of this Falcon is Greenland and continent of North America, north of Hudson's Bay—breeding in latter region. It is also found in all parts of the circumpolar regions. Several varieties are recognized. Six very beautiful specimens of this bird are in the American Museum, Central Park, including the two varieties islandicus and candicans. The variety candicans is nearly pure white, or very faintly barred with dark plumbeous crescents. Variety islandicus has more of a bluish cast, and the whole upper parts are covered with broad transverse bands of dark plumbeous. Specimens are occasionally taken in New England. Variety sacer (McFarlane's genus Falcon), has the size and proportion of islandicus, with the colors of gyrfalco. The Black Gerfalcon, var. labradora, has the ground color of the plumage uniform, very deep, clear, dark plumbeous-brown. The head, except beneath, is unvariegated. The nest of the Gerfalcon is built on inaccessible cliffs. They prey on water-fowl and ptarmagans, and usually build near the roosting-places of sea-fowl. In some instances the nest is found in top of pine-trees. Their flight is similar to that of the Peregrine Falcon, but more elevated, majestic and rapid. Their cries are also like those of that Falcon, being very loud, shrill and piercing.

PRAIRIE FALCON (*Falco lanarius*).—This bird is also called the AMERICAN LANNER. It is the variety polyagrus, which is found in the limits of our country, its habitat being the western division of North America, eastward to Illinois; Oregon to Lower California and Texas. "The American Lanner Falcon," says Prof. Baird, "is so very closely related to the Lanners of Europe and Asia (var. lanarius and var. jugger), that it is very difficult to indicate the differences which separate them." Dr. Cooper regards this as one of the shyest as well as one of the swiftest of Hawks. It prefers the borders of prairies, and preys upon hares, quail, and even larger game. Mr. Ridgway has procured this Hawk as far east as Southern Illinois.

AMERICAN PEREGRINE FALCON (*Falco communis; var. anatum*).—This is also called the DUCK HAWK. It is found over the entire continent of America and adjacent islands. There is a difference of opinion concerning the existence of two distinct species. The most favorably received opinion is that there are two species on the American continent, and that one of them—the northern one—is identical with the European bird. Prof. Baird, however, says: "Both of these views I hold to be entirely erroneous; for, after examining and comparing critically a series of more than one hundred specimens of these birds, from every portion of America (except Eastern South America), including nearly all the West India Islands, I find that, with the exception of the melanistic littoral race of the north-west coast (var. pealei), they all fall under one race, which, though itself exceedingly variable, yet possesses the characters whereby it may always be distinguished from the Peregrine of all portions of the Old World." A variety called the Black Peregrine Falcon (pealei) is found in north-west coast of North America, from Oregon to Litha. The Peregrine Falcon, called also the GREAT-FOOTED HAWK, is a resident of New England throughout the year, being usually found on the sea-shore. It is very powerful, and a swift flyer; the terror of water-fowl, its legitimate prey. Audubon says of it: "I have nowhere seen it so abundant as along the high, rocky shores of Labrador and Newfoundland, where I procured several adult individuals of both sexes, as well as some eggs and young. The nests are placed on the shelves of rocks, a few feet from the top, and were flat, and rudely constructed of sticks and moss. In several instances we found these Falcons breeding on the same ledge with Cormorants." Wilson says of him: "This noble bird had excited our curiosity for a long time. Every visit which we made to the coast was rendered doubly interesting by the wonderful stories which we heard of its exploits in fowling, and of its daring enterprise. There was not a gunner along shore but knew it well; and each could relate something of it which bordered on the marvellous. It was described as darting with the rapidity of an arrow on the Ducks when on the wing, and striking them down with the projecting bone of its breast. Even the Wild Geese were said to be in danger from its attacks, it having been known to sacrifice them to its rapacity. * * It often follows the steps of the gunner, knowing that the Ducks will be aroused on the wing, which will afford it an almost certain chance of success." This species was long greatly valued in Europe for purposes of falconry. Wilson objects to the name *peregrine*, as, he says, our Hawk is not migratory; accordingly, he calls it the Great-footed Hawk, from the fact that its talons are unusually large and rugged. It is about twenty inches in length, and three feet eight inches in extent of wing. The most striking characters of this species are the broad patch of black dropping below the eye, and the uncommonly large feet.

PIGEON HAWK (*Falco lithofalco*), called also the AMERICAN MERLIN.—Habitat, entire continent of North America, south to Venezuela and Ecuador, and the West India Islands. This small Hawk is bold and swift of flight. It is a common spring and fall visitor in New England, and is sometimes a resident in the southern portions. It is eleven inches in length, and twenty-three inches in extent. The whole upper parts are a deep, dark brown, except the tail, which is crossed with bars of white. It has, like many other species, been regarded as a valuable hunting Falcon. A black variety—var. suckleyii—is found on the coast region of Northern California, Oregon and Washington Territory. This variety is of a more uniform and of a darker color. The tail is tipped with white, but the bars are very faintly indicated. Another variety, richardsoni, is seen in the interior regions of North America, between the Mississippi Valley and the Rocky Mountains, and from Texas to the Arctic regions.

APLOMADO FALCON (*Falco femoralis*).—A southern species, with its habitat extended over the whole of South America, and northward through Central America and Mexico, into Texas and New Mexico. It is said to be very abundant on the pampas of South America, where it is not at all shy. It is frequently trained in this region for hunting small game. The Chilian falconers esteem this species highly, and find it very docile, and readily tamed.

AMERICAN SPARROW HAWK (*Falco sparverius*).—This is also called the AMERICAN KESTREL. It is found on the continent of North America, from coast to coast, but not on the islands. Several varieties are recognized. Variety isabellinus has very much darker markings. Though having a very wide distribution, the Sparrow Hawk is not met with in the extreme Arctic regions; latitude 62°, on Great Shore Lake, being the highest northern limit yet recorded. The habits of this bird are rather peculiar. Wilson says of him: "It flies rather irregularly, occasionally suspending itself in the air, hovering over a particular spot for a minute or two, and then shooting off in another direction. It perches on the top of a dead tree or pole in the middle of a field or meadow, and, as it alights, shuts its long wings so suddenly that they seem instantly to disappear; it sits here, in an almost perpendicular position, sometimes for an hour at a time, frequently jerking its tail, and reconnoitering the ground below in every direction for mice, lizards, etc. It frequently plunges into a thicket after small birds, as if at random, but always with a particular, and generally a fatal aim. One day I observed a bird of this species perched on the highest top of a large poplar on the skirts of the wood, and was in the act of raising my gun to the eye, when he swept down with the rapidity of an arrow into a thicket of briars about thirty yards off, where I shot him dead, and, on coming up, found the small field-sparrow quivering in his grasp. Both our aims had been taken in the same instant, and, unfortunately for him, both were fatal. It is particularly fond of watching along hedgerows and in orchards. It will seldom or never eat anything it has not killed itself, and even that, if not in good order, is sometimes rejected." Referring to the resemblance of this bird to the European Kestrel, the editor of *Wilson's Ornithology* says: "The manner of suspending itself in the air is exactly similar to that of our Windhover; and I am not aware that this peculiar manner of hunting is made use of by any other of the *Falconidæ*, with the exception of the Kestrels—that is, those of Europe and Africa. The true Falcons survey the ground by extensive sweeps or a rapid flight, and stoop at once on their prey with the velocity and force of lightning; the others quietly watch their quarry when suspended or perched on a bare eminence or tree in the manner described, and take it by surprise. The whole of the Kestrels are very familiar, easily tamed, and, when in confinement, become even playful. It is remarkable that, perhaps, more Kestrels build and bring to maturity their young in London, than in any other space of the same dimensions. The breeding places there are the belfries of the different churches, where neither the bustle beneath nor the jingle of the bells seems to have any effect upon them."

CARACARA EAGLE (*Polyborus tharus*).—This single species of the genus Polyborus is the only one known. It extends over the whole of tropical and sub-tropical America, excepting some of the West India Islands. It is closely allied to several other South American forms which are peculiarly American. Its habits are quite different from the *Falconidæ* generally, having those of the Vultures and gallinaceous birds to a certain extent, combined. It is terrestrial, and able to run or walk rather gracefully. The present species is sometimes called King Buzzard. Two varieties are recognized. Our bird is the variety audubonii. It is very common in Florida. Mr. Boardman found it abundant there, associated with the Vultures. Dr. Coues found it not a rare bird in Arizona.

FISH HAWK (*Pandion haliaëtus*).—This bird, called also the AMERICAN OSPREY, is the only species of its genus. Its range is very extensive, being almost cosmopolitan. The present variety, carolinensis, is found over the whole of North America, in North Brazil and the West India Islands. Wilson says: "The first appearance of the Fish Hawk in spring is welcomed by the fishermen as the happy signal of the approach of those vast shoals of shad, herring, etc., that regularly arrive on our coasts, and enter our rivers in such prodigious numbers. The nest of the Fish Hawk is something very remarkable. It is usually built on the top of a dead or decaying tree. Externally, large sticks—from half an inch to an inch and a half in diameter, and two or three feet in length—piled to the height of four or five feet, and from two to three feet in breadth, were intermixed with corn-stalks, sea-weed, pieces of wet turf in large quantities, mullein-stalks, and lined with dry sea-grass; the whole forming a mass very observable at a half a mile distant, and large enough to fill a cart, and be no inconsiderable load for a horse. The flight of the Fish Hawk, his manœuvres while in search of fish, and his manner of seizing prey, are deserving of particular notice. In leaving the nest, he usually flies direct until he comes to the sea, then sails around in easy curves, turning sometimes in the air, as on a pivot, apparently without the least exertion. His remarkable length and curvature of wing distinguish him from any other Hawk. Suddenly he is seen to check his course, as if struck by a particular object, which he seems to survey for some minutes with such steadiness that he appears fixed in air, flapping his wings. At once, from this sublime aërial height, he descends like a perpendicular torrent, plunging into the sea with a loud, rushing sound, and with the certainty of a rifle. In a few moments he emerges, bearing in his claws his struggling prey, which he always carries headforemost, and, having risen a few feet above the surface, shakes himself as a water spaniel would do, and directs his heavy and laborious course directly for the land. In one instance a shad was taken from a Fish Hawk which weighed six pounds." The Fish Hawk is considered as the most numerous

of its genus within the United States. On a small island of the Atlantic Coast three hundred nests of these birds were found. A singular trait in the character of this bird is that of allowing the Purple Grakle to build its nest on the margin of its own. The interstices of the immense concourse of sticks that form the Fish Hawk's domicile are occupied by the Grakles, four or five often being seen on one nest, "like humble vassals around the castle of their chief, laying, hatching their young, and living together in mutual harmony." The Fish Hawk is a constant summer resident near the mouth of our large rivers. In Maine, at the mouth of the Kennebec and the Penobscott, and among the islands of Casco Bay, he may be seen, attended pretty closely by the Bald Eagle, who ignobly lives by pilfering his rightful game.

FORK-TAILED KITE (*Nauclerus forficatus*).—This is a peculiarly American genus, having only one species, belonging to the tropical and subtropical regions on both sides of the equator. The Swallow-tailed Hawk, as this species is called in the Southern States, is sometimes seen as far north as Pennsylvania, on the Atlantic Coast, but is common in the Mississippi Valley to Wisconsin. It breeds in Illinois and Iowa. It is said to be exceedingly abundant in the former State. It is found in Cuba, and is accidental in England. The specific characters, as given by Prof. Baird, are as follows: "Whole head and neck, lining of wings, broad band across the rump, and entire lower parts, pure white; interscapulars and lesser wing coverts, rich, dark, soft, bronzed-purplish-black; rest of upper parts, including lower part of rump, upper tail coverts, and tail, more metallic-slaty-black; feathers somewhat greenish basally, more bluish terminally, with a peculiar soft, milky appearance, and with very smooth compact surface; tertials almost entirely white, black only at tips; white on under side of wing occupying all the coverts, and the basal half of the secondaries. Wing, 15.40–17.70; tail, 12.50–14.50." From the peculiar form of this bird, its slender body and elongated tail and wings, it naturally is exceedingly graceful in its flight. Its food consists mostly of the larger winged insects, as grasshoppers; and it is described as being fond of the grubs of wasps, which it skilfully extracts from the nest. Its habit seems to lead it mostly over streams, or their neighborhood. Mr. Ridgway finds it living in Illinois during the summer on small snakes, building its nest in the oak or hickories which border the streams intersecting the prairies. Here, in August, it becomes very abundant, feeding also on the insects of the region. Audubon speaks of these birds as being astonishingly rapid in flight, the deep curves they describe, their sudden doubling and crossings, and the extreme ease with which they seem to cleave the air, never failing to excite admiration. On the ground, their movements are said to be awkward in the extreme. When wounded, they seldom strike with their talons, or offer serious resistance. They never attack other birds or quadrupeds to prey upon them. They have a decidedly peculiar method of feeding on the wing, in this respect appearing more like a large Swallow than a Hawk. They have been observed in large flocks, flying through a swarm of bees, clutching the insects with their small feet, and eating them while on wing.

BLACK-SHOULDERED KITE (*Elanus lencurus*), called also the WHITE-TAILED KITE.—This species inhabits the tropical and warmer temperate regions of America, excepting the West Indies. It reaches as far north as Southern Illinois, and in California it is a winter resident. This species was first introduced into our Fauna by Prince Chas. Lucien Bonaparte, whose specimen was secured from East Florida. Audubon obtained one from near Charleston, S. C., and describes it as poising itself in the manner of the Common Sparrow Hawk. It would suddenly close its wings, plunge toward its prey with great velocity, making a peculiar noise with its wings as it passed through the air. Its cries, on being wounded, resemble those of the Mississippi Kite. Like the preceding, this bird feeds on insects as well as small reptiles and mice, coursing in search of its prey in the manner of the Marsh Harrier. "The common name of this Hawk in Chili is Bailarin (from the verb *bailar*, to dance or balance), from the graceful and easy manner in which it seems almost to float upwards or to sink in the air."—*N. A. Birds.*

MISSISSIPPI KITE (*Ictinia mississippiensis*)—Plate V, fig. v.—This is also called the BLUE KITE. Its habitat is Central Mexico and Southern United States, reaching as far north as Wisconsin and Illinois, in the Mississippi Valley. On the prairies of Southern Illinois it is said to be exceedingly abundant. On the Atlantic border it is not seen above South Carolina. This species also has the habit of capturing and eating insects while on the wing. Mr. Ridgway describes the bird as exceedingly graceful in its evolutions. Wilson says of it: "In my perambulations I frequently remarked this Hawk sailing about in easy circles, and at considerable height in the air, generally in company with the Turkey Buzzards, whose manner of flight it so exactly imitates as to seem the same species, only in miniature, or seen at a more immense height." Wilson was at loss to comprehend how these two birds, whose food and manners in other respects are so different, should so frequently associate together in air. This Kite measures fourteen inches in length, and three feet in extent of wings—an enormous spread of wing as compared with the size of the body.

HOOK-BILLED KITE (*Rostrhamus sociabilis*).—This bird, called also EVERGLADE KITE and variety plumbeus, by Ridgway, has its habitat in the West Indies and in Southern Florida. Mr. Maynard, author of the *Birds of Florida*, discovered this species breeding in the everglades of Florida. By the Seminole Indians the bird is called *So-for-funi-kar*. It is described as very sociable in its habits. In this respect it differs essentially from other birds of prey; though I have seen the Rough-legged Buzzard associated in a flock of a dozen or more, hovering over the marshes at Nahant, where they were hunting for snakes and mice. In their flight the Hook-bills re-

semble the Marsh Hawk. The food consists largely of a fresh-water shell (Pomus depressus), so far, at least, as relates to the specimens captured by Mr. Maynard.

MARSH HAWK (*Circus cyaneus*).—Of the numerous species of this genus, North America has but one. "Birds of this genus," say the authors of *North American Birds*, "frequent open, generally marshy, localities, where they course over the meadows, moors or marshes, with a steady, gliding flight, seldom flapping, in pursuit of their food, which consists mainly of mice, small birds and reptiles. Their assault upon the latter is sudden and determined, like the 'Swift Hawks' or the species of Accipiter." The North American species, which is also called American Harrier, is twenty-one inches long, and three feet eleven inches in extent of wing. It is, according to Wilson, particularly serviceable to the rice-planters of the Southern States, as it drives away the immense flocks of rice-birds from the plantations. As it sails low and swiftly over the surface of the field, it keeps the flocks in perpetual fluctuation, and greatly interrupts their depredations. The planters consider one Marsh Hawk to be equal to several negroes for alarming the rice-birds. The Marsh Hawk is very common in New England, and there it is considered as less destructive than any other species. It is one of the most widely distributed of any North American bird, being abundant everywhere, except in the south-eastern portion of the United States.

SHARP-SHINNED HAWK (*Nisus fuscus*).—This species is found over the entire continent of North America, in the Bahamas; but not in the West Indies, where it is replaced by the Astur fringilloides. It is one of the most common species in New England as a summer inhabitant. Audubon says of it: "While in search of prey, it passes over the country, now at a moderate height, now close over the land, in so swift a manner, that, although your eye has marked it, you feel surprised that the very next moment it has dashed off, and is far away. In fact, it is usually seen when least expected. The kind of vacillation or wavering with which it moves through the air, appears perfectly adapted to its wants, for it undoubtedly enables this little warrior to watch, and to see at a single quick glance of its keen eyes, every object, whether to the right or to the left, as it pursues its course." Its impetuosity is well described by Nuttall, who says: "Descending furiously and blindly upon its quarry, a young Hawk of this species broke through the glass of the greenhouse at the Cambridge Botanic Garden, and, fearlessly passing through a second glass partition, was only brought up by a third, and caught, though little stunned by the effort." The flight of this Hawk is considered to be so peculiar as to readily distinguish it. Its short wings and long tail are readily recognized, and its habit is to fly high in air for a few moments and then close to the ground, suddenly disappearing in the tall grass or the thicket for any object it pursues. In many respects it resembles the Goshawk in miniature. Wilson was intensely surprised at the peculiar dash of this little bird. He says: "It seemed to throw itself from one quarter of the heavens to another with prodigious velocity, inclining to the earth, swept suddenly down into a thicket, and instantly reappeared with a small bird in his talons. The rapidity and seeming violence of these zigzag excursions were really remarkable, and appeared to me to be for the purpose of seizing his prey by sudden surprise and main force of flight." The female of this species is remarkable for its superiority in size to the male; it is thirteen inches in length, and twenty-five inches in extent of wing.

COOPER'S HAWK (*Nisus cooperi*).—This species is found in most parts of North America, but is rare in the western portion. It resembles the last-named species, but is considerably larger. A variety, called the Mexican Blue-backed Hawk, var. mexicanus, is found in the western region of North America and in Mexico. Though formerly rare in New England, it is now said to be quite abundant there, and is known by the name of Hen Hawk. It is bold and daring, often making an attack upon fowls of the barnyard much larger than itself. It moves along in a silent, gliding manner, swiftly and in a straight course, and seldom sails in circles like other species.

AMERICAN GOSHAWK (*Astur palumbarius*).—Wilson says of this bird: "If this be not the celebrated Goshawk formerly so much esteemed in falconry, it is very closely allied to it." It is a common winter visitor in New England. Prof. Verrill says that it breeds in Maine. Audubon says of it: "His flight is extremely rapid and protracted. He sweeps along the margins of the fields, through the woods, and by the edges of ponds and rivers, with such speed as to enable him to seize his prey by merely deviating a few yards from his course; assisting himself on such occasions by his long tail, which, like a rudder, he throws to the right or the left, upwards or downwards, to check his progress, or enable him suddenly to alter his course. At times he passed like a meteor through the underwood, where he secures hares and squirrels with ease. Should a flock of wild pigeons pass him when on these predatory excursions, he immediately gives chase, soon overtakes them, and, forcing his way into the very centre of the flock, scatters them in confusion, when you may see him emerging with a bird in his talons, and diving towards the depth of the forest to feed upon his victim. When travelling he flies high, with a constant beat of the wings, seldom moving in large circles, like other Hawks." This bird has been known to attack a flock of pigeons, and kill several, letting them drop while crossing a river, and then afterwards picked them up and carried them off singly to the shore. The Goshawk is not adapted for long flights; its wings are so shaped that it is more natural for the bird to make short dashes near the earth, unlike in this respect some other species that capture their prey by the chase, in the air. As a trained bird the European variety is considered to be one of the most valuable. Its mode of hunting is said to be singularly like that of the Cheetah. Like that animal, it is not nearly so swift as the prey, and, therefore, is

obliged to steal upon them, and seize its victim by a sudden and unexpected pounce. The female Goshawk is strong enough to bear off a hare. This species is the handsomest of all our native Falcons; in full plumage, its lilac hues and the trim, graceful form of its body render it surpassingly beautiful. The total length of the female is twenty-two to twenty-four inches; wing, about fourteen. The male is about twenty inches in length. A characteristic of this bird is the extremely upright posture it assumes when perching.

HARRIS' BUZZARD (*Parabuteo unicinctus*).—The habitat of this bird is given as middle or northern tropical America, from Isthmus of Panama northward into the Southern United States. It has a very limited range in the United States. Those found in our borders belong to a variety called harrisi. Audubon named it for his friend Mr. Edward Harris. It is considered as heavy and sluggish in habit; and it frequents streams of water, where it obtains for its food small reptiles that inhabit the banks. Its nest is constructed of coarse flags and water-plants over the stream near its hunting-ground.

GRUBER'S HAWK (*Onychotes gruberi*).—"This genus," say the authors of *North American Birds*. "has no very near relatives among the American *Falconidæ*, nor, indeed, among those of other portions of the world. It is perhaps more closely related to the genus Rupornis of South America, from which, however, it is very distinct. It is represented by a single species, the type of which, supposed to have come from California, still remains unique. Nothing is known of its habits. The specimen was sent to the Smithsonian Institution, where it remains."

BROAD-WINGED HAWK (*Buteo pennsylvanicus*).—The habitat of this Hawk is Eastern North America, and on the Atlantic border southward to Central America. It has been considered rare in New England until lately, but is now often seen as a summer visitor. Its flight is rapid, broken usually by long intervals of soaring, with shorter periods of flapping of the wings. It is more commonly seen in the wilder districts of the interior. They prey upon pigeons, quail, and birds of this size, seldom attacking larger. Wilson says: "Its great breath of wing or width of the secondaries, and also of its head and body, when compared with its length, struck me as peculiarities. It seemed a remarkably strong-built bird, and handsomely marked." Audubon considered it as spiritless, inactive, and deficient in courage. It seldom chases other birds of prey, but is itself annoyed frequently by the little Sparrow Hawk, the Kingbird and the Martin. It feeds on small animals and insects. It is solitary in its habits, and is by no means shy. Mr. Boardman, of Calais, Me., whose observations are very accurate, differs essentially in his estimate of this bird's courage. He gives several instances of dangerous attack upon individuals who were attempting to remove eggs from its nest.

BAIRD'S HAWK (*Buteo swainsoni*).—This is also called SWAINSON'S HAWK. It is found in the western regions of America, and as far east as the Mississippi Valley, and north to the Arctic regions. Its length is twenty-one inches and a half—female; extent of wing, fifty-four. A variety, oxypterus, called the Sharped-winged Hawk, is common to the southern border of the United States and tropical America. Its principal food is grasshoppers and small animals. Dr. Lincecum, of Texas, relates an instance of its following a prairie fire to snatch up the small mammals and insects that are driven out by the heat. He says farther: "When any one approaches their nest on the prairie, they will make a pretty bold attempt to frighten or decoy him from it. It first tries to lead the intruder off by alighting in the grass near by, and screeching loudly as if something greatly was the matter; you approach him, and, with much seeming difficulty, it makes out to move off a little farther, still screeching louder than before; and this piece of deception he will repeat time after time, improving a little in its powers of locomotion as it gets you further from the nest, until it judges you are far enough—then you have lost the place in the unmarked sea of grass—when it seems to fly as well as ever; it circles round once or twice, going still farther off, and settles silently down in the deep grass; this last performance evidently to induce the belief that it has returned to its nest. If you refuse to be led astray by these manœuvres, and remain about the nest, it will make a good fight."

BAND-TAILED HAWK (*Buteo zonocercus*).—This bird is a native of Guatemala, Mexico, and adjoining parts of United States. In Arizona and Southern California it is occasionally seen. Dr. Cooper first obtained specimens in our borders; he represents it as rather sluggish and tame. It feeds on beetles and other insects.

RED-SHOULDERED HAWK (*Buteo lineatus*).—The habitat of this species is Eastern North America, south as far as Florida, and west to Texas and the tributaries of the Missouri. This refers to the variety lineatus; another variety, elegans, called the Red-bellied Hawk, is found on the Pacific side of the continent. Audubon says of him: "This bird is one of the most noisy of his genus, during spring especially, when it would be difficult to approach the skirts of woods bordering a large plantation without hearing its discordant, shrill notes, *ka-hee! ka-hee!* as it is seen sailing in rapid circles at a very great elevation. Its ordinary flight is even and protracted, excepting when it is describing the circles just mentioned, when it often dives and gambols. It is a more general inhabitant of the woods than most of our other species, particularly during the summer, and in autumn and winter. At the approach of spring this species begins to pair; and its flight is accompanied by many circlings and zigzag motions, during which it emits its shrill cries. The male is particularly noisy at this time. He gives chase to all other Hawks, returns to the branch on which his mate has chanced to perch, and caresses her." This is a common bird in New England, being a resident throughout the year in the eastern portions.

RED-TAILED HAWK (*Buteo borealis*).—This is another common resident in New England throughout the year. Several varieties are recognized. B. var.

krideri, the White-bellied Red Tail, is a resident of the Middle United States, from Minnesota to Texas. Var. lucasanus is found in Lower California, and called there the St. Lucas Red-tail. Variety calurus, the Western Red-tail, is native of the region between the Rocky Mountains and the Pacific. These varieties differ from each other in minor particulars, but not sufficiently to render them distinct species. This is a strong and powerful bird, having the faculty of soaring high, and at long intervals. Its habit is to watch cautiously its prey, and dart upon it from some fixed point—differing from some who chase and seize their prey in the air. Its caution prevents its near approach to the barnyard, unless it is considerably isolated. It has obtained a local name of Squealing Hawk, from a habit of uttering a harsh scream when it flies. Audubon says that the sexes separate after the young are reared, and often are quite hostile to each other. The Red-tail is twenty inches long and three feet nine inches in extent of wing.

HARLAN'S HAWK (*Buteo harlani*).—Called also the BLACK WARRIOR. This Hawk is found in the South-western States, Texas and Guatemala. It was first described by Audubon, from a specimen shot by him in Louisiana. The specimen is now in the British Museum. It is allied closely to the preceding species, though somewhat smaller. Its flight is rapid and strong. In hunting, it seems to prefer poultry and the wild ducks. Professor Snow has lately captured a specimen in Kansas.

COOPER'S RED-TAIL HAWK (*Buteo Cooperi*).—This species is found in California. A single specimen was shot by Dr. Cooper. "The nearest ally of this species is the B. ferox of the Palæarctic realm (Northern Asia and Africa and portions of Europe), which has exactly the size and proportions of the present bird, and, in certain stages, a very similar plumage."—*North American Birds.* There is yet but one specimen known to collections.

CALIFORNIA SQUIRREL HAWK (*Archibuteo ferrugineus*).—This Hawk inhabits Western North America, from California to the Missouri. It was first described and brought to notice by Professor Lichtenstein, a Prussian naturalist, and afterwards by Colonel Fremont, in 1846, being one of the many instances of new discoveries since the advancement of expeditions into the newer portions of the great Western Territories. The adult male is twenty-two inches in length and fifty-four and a half in extent of wing.

ROUGH-LEGGED HAWK (*Archibuteo lagopus*)—Plate 3, fig. 7.—A variety of this Hawk, called Sancti-johannis, and in some quarters Black Hawk and Rough-legged Buzzard, is an occasional winter visitor in New England. It inhabits the whole of North America, breeding far to the north. "The Rough-legged Hawk of North America bears so close a resemblance to the European species in every respect—plumage, habits, eggs—that the two are generally considered to be identical."—*North American Birds.* It is said to be more nocturnal in its habits than any of our Hawks. Wilson's description gives an excellent idea of its character. "This handsome species, notwithstanding its formidable size and appearance, spends the chief part of the winter among our low swamps and meadows, watching for frogs, mice, lame ducks and other inglorious game. Twenty or thirty individuals have regularly taken up their winter quarters, for several years past, in the meadows below this city [Philadelphia], where they spend their time watching along the dry banks like cats, or sailing low and slowly over the surface of the ditches. They seldom fly far—usually from one tree to another, at no great distance—making a loud squealing as they arise, something resembling the neighing of a colt, though in a more shrill and savage tone." I have seen a dozen or more of these birds hovering over in short circuits and intently watching the surface of low grounds at Nahant, a locality noted for an abundance of small snakes. The species is readily recognized by the dark band or blotch upon its breast, which is conspicuously contrasted with whitish below. The variety Sancti-johannis is nearly black in plumage.

GOLDEN EAGLE (*Aquila chrysaëtus*)—Fig. 99, vol. i., p. 248.—"This genus is almost peculiar to the Old World, where about seventeen species are known, while America has no member of the genus exclusively its own, the single North American species being the same as the European one. The American bird is darker in all its shades of color, the difference being most marked in the young plumage. The American bird appears to be rather the larger."—*North American Birds.* Audubon says that they are occasionally seen on the Hudson River and in Maine. It is considered rare, however, in New England. Dr. Brewer says it breeds in the mountainous portions of Maine, New Hampshire and Vermont. "Although possessed of a powerful flight, it has not the speed of many Hawks, nor even that of the White-head Eagle. It cannot, like the latter, pursue and seize on the wing the prey it longs for, but is obliged to glide down through the air for a certain height to insure the success of its enterprise. The keenness of its eye, however, makes up for this defect, and enables it to spy at a great distance the objects on which it preys; and it seldom misses its aim, as it falls with the swiftness of a meteor towards the spot on which they are concealed. When at a great height in the air, its gyrations are exceedingly beautiful, being slow and of wide circuit, and becoming the majsety of the king of birds. Their notes are harsh and sharp, resembling at times the barking of a dog, especially about the breeding season, when they become exceedingly noisy and turbulent. Young fawns, raccoons, hares, wild turkeys and other large birds are their usual food. They are nice and cleanly in habit; muscular, strong and hardy; capable of bearing extreme cold without injury. The species seldom removes far from its place of residence, and the attachment of two individuals of different sexes appears to continue for years. They do not obtain the full beauty of their plumage until the fourth year. In the second year they have the appearance which has given the name *ring-tail* to

what was thought to be a separate species."—*Audubon.* Wilson adopted the name Ring-tailed Eagle for this species, not having the flood of experience which has come since his day. He says: "This noble bird, in strength, spirit and activity, ranks among the first of its tribe. I have once or twice observed it sailing along the Alpine declivities of the White Mountains of New Hampshire, early in October, and again over the highlands of the Hudson, not far from West Point. Its flight was easy, in high, circuitous sweeps, its broad tail expanded like a fan." This Eagle measures nearly three feet in length, has an expanse of nine feet; and Mr. Ridgway found it common in the Great Basin, along the line of the fortieth parallel, where it is called the Mountain Eagle. The Eagle is supposed to be a very long-lived bird, extending its existence even to a century or more. In captivity it is known, at Vienna, to have lived over a hundred years.

GRAY SEA EAGLE (*Haliaëtus albicilla*).—Of this genus about nine species are known, of which two are North American, one being peculiar to this continent—the H. leucocephalus, emblem of our Federal Union. The habits of the Sea Eagles differ essentially from those of the true Eagles (Aquila). They frequent the shores of the sea, lakes or large rivers, instead of mountainous portions, and feed chiefly—some of the species entirely—on fish, some resembling the Fish Hawks in their habits. The habitat of this species is in Europe and Greenland. It frequents that part of the country adjacent to the sea, rearing its young on the rocky cliffs. It has not been found on our continent out of Greenland. It is a fierce and determined bird, and fights with great power when attacked. It does not return year after year, like others, to its breeding-places. The head is covered with long, drooping feathers, each feather being ashy-brown and darker in its centre than at its edges. The rest of the body is dark brown, with here and there a lighter spot or streak, the primaries being nearly black. The tail is rounded, and of a pure white color in the adult Eagle and brown in the immature bird. The legs, toes, beak and cere are yellow and the claws black.

BALD EAGLE (*Haliaëtus leucocephalus*)—Plate V, fig. viii.—This is the American Eagle, so-called. Audubon says of it: "The figure of this noble bird is well known throughout the civilized world, emblazoned as it is on our national standard, which waves in the breeze of every clime, bearing to distant lands the remembrance of a great people living in a state of peaceful freedom." His great strength, joined to his unequalled powers of flight, render him highly conspicuous among his brethren. Franklin says: "He is a bird of bad moral character; he does not get his living honestly. You may have seen him perched on some dead tree, where, too lazy to fish for himself, he watches the labor of the Fish Hawk; and when that diligent bird has at length taken a fish, and is bearing it to his nest, the Bald Eagle pursues and takes it from him. Besides, he is a rank coward. The little King-bird, not bigger than a Sparrow, attacks him boldly, and drives him out of the district. He is, therefore, by no means a proper emblem for the brave and honest Cincinnati of America, who have driven all the King-birds from our country." Audubon describes and figures a bird which he called the WASHINGTON EAGLE (H. washingtoni). As no other specimen has been seen, and as the Bald Eagle is known to have a dark-brown plumage during its first years, like that which Audubon considered as characteristic of the Washington bird, it is now thought that his specimen was none other than a remarkably fine and large female of the present species. The white head and tail only appear after several years of moulting. Wilson gives the following account: "Formed by nature for braving the severest cold, feeding equally on the produce of the sea and of the land, possessing powers of flight capable of outstripping even the tempest, unawed by anything but man, and from the ethereal heights to which he soars looking abroad at one glance on an immeasurable expanse of forest, fields, lakes and ocean deep below him, he appears indifferent to the little localities of change of seasons, as in a few minutes he can pass from summer to winter, from the lower to the higher regions of the atmosphere. He is therefore found at all seasons in the countries which he inhabits, but prefers such places as have been mentioned above, for the great partiality he has for fish. Elevated on the high, dead limb of some gigantic tree that commands a wide view of the neighboring shore and ocean, he seems calmly to contemplate the motions of the various feathered tribes that pursue their busy avocations below. High over all these hovers one whose action instantly arrests his whole attention. By his wide curvature of wing and sudden suspension in air, he knows him to be the Fish Hawk, settling over some devoted victim of the deep. His eye kindles at the sight, and, balancing himself with half-opened wings on the branch, he watches the result. Down, rapid as an arrow from heaven, descends the distant object of his attention, the roar of its wings reaching the ear as it disappears in the deep, making the surges foam around. At this moment the eager looks of the Eagle are all ardor, and levelling his neck for flight, he sees the Fish Hawk once more emerge, struggling with his prey, and mounting in the air with screams of exultation. These are the signals for our hero, who, launching into the air, instantly gives chase, and soon gains on the Hawk. Each exerts his utmost to mount above the other, displaying in these *rencontre* the most elegant aërial evolutions. The unencumbered Eagle rapidly advances, and is just on the point of reaching his opponent, when, with a sudden scream, the latter drops his fish. The Eagle, poising himself for a moment, as if to take a more certain aim, descends like a whirlwind, snatches it in his grasp ere it reaches the water, and bears his ill-gotten booty silently away to the woods." Wilson records an instance which shows the great power and courage of this bird. An Eagle had robbed a Fish Hawk of a fish, when the latter made an attempt to regain his prey. The Eagle deliberately turned on his back, in

mid-air, and while he held the fish with one talon, struck out, *guardant*, with the other. The Bald Eagle is very abundant, during the summer months, at the mouth of the Kennebec River, in Maine, and among the islands of Casco Bay. From the deck of the steamer one may at any time see several of the great birds in view, especially between Sequin Island and Bath. Here they watch, as is their habit, the Fish Hawk; and the observer is often treated to a view of the exciting chase which occurs when the Hawk has secured his prey. A number of fine Bald Eagles, in various stages of plumage, are kept at the Central Park Zoölogical Garden. "The nest of this species," says Wilson, "is generally fixed on a very large and lofty tree—often in a swamp or morass—and difficult to be ascended. On some noted tree of this description—often a Pine or Cypress—the Bald Eagle builds year after year, for a long series of years. The nest is large, being added to and repaired every season, until it becomes a black, prominent mass, observable at a considerable distance. It is formed of large sticks, sods, earthy rubbish, hay, moss, etc." The length of this Eagle is three feet, and its average extent of wing seven feet. The male is generally two or three inches shorter than the female, as is the case, proportionately, with most of the *Falconidæ*. The plumage of the male is also lighter, and he is said to be less daring than his mate. This, too, is said to be common with other birds of prey.

Family—CATHARTIDÆ.

The Vultures.

The Vultures are naked-headed, carrion-feeding, rapacious birds. There are two families recognized at present, those of the Old World being regarded as sufficiently different to warrant their separation from those of the New World. The Old World Vultures are nearer allied to the *Falconidæ*. Though the two families resemble each other in external characters, the anatomical structure—their internal anatomy—differs essentially. "In habits, the *Cathartidæ* resemble vulturine *Falconidæ* of the Old World. They lack the strength and spirit of typical Raptores, and rarely attack animals capable of resistance. They are voracious, and indiscriminate gormandizers of carrion and animal refuse of all sorts, efficient and almost indispensable scavengers in warm countries, where they abound. They are uncleanly in their mode of feeding; the nature of their food renders them ill-scented; and when disturbed they eject the fetid contents of the crop. Although not gregarious, they assemble in multitudes where food is plenty; and some species breed in communities. When gorged, they appear heavy and indisposed to exertion, usually passing the period of digestion motionless, in a listless attitude, with their wings half spread. But they spend most of the time on the wing, circling high in the air. Their flight is easy and graceful in the extreme, and capable of being indefinitely protracted. On the ground they habitually walk, instead of progressing by leaps. Possessing no vocal apparatus, the Vultures are almost mute, emitting only a weak hissing sound."—*Coues*. The *Cathartidæ* all belong to the tropical regions.

CALIFORNIA CONDOR (*Pseudogryphus californianus*—Plate V, fig. vii.—This Vulture rivals in size the great Condor of South America. Its habitat is the Pacific Coast region, from the mouth of the Colorado to the Columbia. It is not known in Mexico, but is confined mostly to the warmer portions of California. Dr. Newberry says that it was to him a pleasant portion of every day's experience, in his march through Sacramento Valley, to watch the graceful evolutions of this Vulture. In its colors the combination was a pleasing one, while its flight was easy and effortless beyond that of any other bird. Though a common bird in California, he found it much more shy and difficult to shoot than its associate, the Turkey Buzzard. This Vulture possesses immense muscular powers. Dr. Heerman states that four of them dragged the body of a young grizzly bear, that weighed over a hundred pounds, the distance of two hundred yards. "Their senses of smell and sight are very acute, especially the latter; and when searching for prey they soar to a very great height, and, if they chance to see a wounded animal, they immediately follow and attack it whenever it sinks down. The first comers are soon followed by others, and it is not long before the carcass is reduced to a skeleton. Their flight is slow, steady and graceful, and they glide along with little or no perceptible motion of the wings, the tips of which are curved upward in flying, in the manner of the Turkey Buzzard. They are said to appear most numerous and to soar the highest preceding thunder-storms and tempests."—*North American Birds*. The nest is composed of a few loose sticks, generally situated in the crevice of a rock. Dr. Canfield asserts that he has seen as many as a hundred and fifty of these birds around the carcasses of antelopes he had killed. He also says that they sighted their prey. The total length of the California Vulture is forty-five to fifty inches; extent of wings about nine or ten feet.

CARRION CROW (*Catharista atrata*).—Called, also, Black Vulture. This genus has only one species, and that confined to the tropical portions of America. It is found more abundant near the sea coast, but on the Pacific side of the United States it is not known; on the Atlantic Coast it is not seen above Wilmington, N. C. In the West India Islands these birds are quite plentiful, having the same habit as the Turkey Buzzard. At Charleston and Savannah they are half domesticated and very abundant, being prized as scavengers. They do not walk with the freedom of the Buzzard, and their flight is much less graceful. Audubon says of it: "The Carrion Crow, in common with the Turkey Buzzard, possesses great power of recollection, so as to recognize at a great distance a person who has shot at them, and even the horse on which he rides. At the commencement of the love season, about the beginning of February, the gesticulation and parade of the males are extremely ludicrous. They first strut somewhat in the manner of the

Turkey Cock, then open their wings, and, as they approach the female, lower their head, its wrinkled skin becoming loosened so as entirely to cover the bill, and emit a puffing sound, which is by no means musical. They never lay more than two eggs, and they are deposited on the ground, or on a hollow log. "The Black Vultures," says Wilson, "are indolent, and may be observed in companies, loitering for hours together in one place. They do not associate with the Turkey Buzzards, and are much darker in their plumage than the latter. Their mode of flight, also, varies from that of the Turkey Buzzard." The Black Vulture flaps its wings five or six times rapidly, then sails with them extended nearly horizontally. The Turkey Buzzard seldom flaps its wings, and, when sailing, they form an angle with the body upwards. This Vulture is twenty-six inches in length, and four feet four inches in extent of wing.

THE TURKEY BUZZARD (*Rhynogryphus aura*).—This bird is more familiar to the residents of the Southern States than elsewhere, though it inhabits the whole of temperate America. It is regarded as a useful scavenger, and is protected in large towns; indeed, it is often to be seen roosting composedly upon the roofs of the more urban portions, ready to pick up any stray morsel that attracts notice in the busy street. The summer range of the Turkey Vulture extends into the British possessions of North America, but it is rarely seen in the Eastern States north of New York. On that portion of the Florida Reef about Key West it is a constant resident, though it is not seen on the other islands, which are not inhabited. For detailed description of this species, see vol. i, page 243.

BURROUGHS' VULTURE (*Rhinogryphus burrowvianus*).—This is the smallest of all the Vultures, resembling the Turkey Vulture, but having no ruff about the neck, as in that species. Its habitat is along the coasts of Mexico, on the Pacific and Gulf sides, and in Lower California. The naturalist Bartram, of South Carolina, described a Vulture, concerning which Prof. Baird has the following, in *Birds of North America, Pacific R. R. Report:* "The Sacred Vulture of Bartram (*Sarcorhampus sacer*) is a species described by that author, in the last century, as abundant in Florida, but has not been observed or identified anywhere since his time. This has tended to throw a doubt on its existence; but recent information renders it probable that this, or at least a species different from the Vultures just described, is found about Lake Okechobee, in Southern Florida, where it is called King Buzzard." Bartram, in *Travels in Florida*, describes it thus: "Bill long and straight almost to the point, where it is hooked or bent suddenly down, and sharp; the head and neck bare of feathers nearly down to the stomach, where the feathers begin to cover the skin, and soon become long and of soft texture, forming a ruff or tippet, in which the bird, by contracting his neck, can hide that as well as his head. The bare skin on the neck appears loose and wrinkled, which is of a bright yellow color, intermixed with coral-red. The hinder part of the neck is nearly covered with short, stiff hair; and the skin of this part of the neck is of a dense purple color, gradually becoming red as it approaches the yellow of the sides and fore part. The crown of the head is red. There are lobed lappets, of a reddish-orange color, which lay on the base of the upper mandible. The plumage of the bird is generally white or cream color, except the quill feathers of the wings and two or three rows of the coverts, which are beautiful dark brown. The tail, which is rather large and white, is tipped with this dark brown or black; the legs and feet of a clear white. The eye is encircled with a gold-colored iris; the pupil black."

FAMILY—COLUMBIDÆ.

THE PIGEONS.

BAND-TAILED PIGEON (*Columba fasciata*).—This Pigeon was first met with by Long's Expedition to the Rocky Mountains, and described by Say in 1823. It is found on the western slope of the Rocky Mountains, extending to the Pacific. Mr. Nuttall says that they are always in flocks. Dr. Newberry met with this Pigeon in many places during his survey, and speaks of it as an attractive bird, about the size and with many of the habits of the domestic Pigeon. Its colors are: Ash above, inclining to olivaceous on the back, and with a fine bluish cast on the rump, under surface of wings and sides; larger wing coverts and secondaries, with primaries, distinctly edged with white; a narrow half collar of white across the upper portion of the nape. Its length is about fifteen inches; wing eight, and tail six.

WHITE-HEADED PIGEON (*Columba leucocephala*).—The White-head is confined to the Florida Keys and the West Indies, being abundant in the latter country. They are exceedingly shy, affecting dark, shady retreats. Specimens have been kept in confinement, and they seem to become somewhat domesticated, but are apt to return to their wild state. The length is thirteen inches and a half; wing seven; tail nearly eight. Its general color is a very dark slate blue; primaries and tail darker; upper half of the head, from the bill to the nape, pure white, not reaching the edge of the eyelids; a triangular patch of dark maroon-purple on the occiput, and below it a semi-circular "cape," covering the nape, of metallic brassy-green, each feather distinctly bordered externally with velvety-black, producing a squamate appearance. The bill is a deep purple, the end light blue; iris white; legs, deep lake-red.

RED-BILLED DOVE (*Columba flavirostris*)—This is a South-western species, inhabiting the Lower Rio Grande and Mexico. They are there very common, but are secluded. Their flight is said to be exceedingly rapid, and they are regarded as very handsome. The head and neck all round, breast, and a large patch on the middle and lesser wing coverts, light chocolate-red, the latter deeper and more opaque-red; the middle of the back, scapulars and tertials, olive; the rest of the body, wings and tail, very dark slaty-blue; bill and legs purple; eyes purple. Length fourteen inches; wing eight; tail 5.70.

WILD PIGEON (*Ectopistes migratorius*)—Fig. 122, vol i, p. 390.—This well-known bird, called also

PASSENGER PIGEON, is found east of the great central plains of North America, and not on the Pacific Coast. The immense flocks of these birds are a never-failing source of surprise to the observer. Audubon speaks of their aërial evolutions as beautiful in the extreme, especially when a Hawk pressed upon the rear of a flock. All at once, like a torrent, and with a noise like that of thunder, they rushed together into a compact mass, and darted forward in undulating lines, descending and sweeping near the earth with marvellous velocity, then mounting almost perpendicularly in a vast column, wheeling and twisting so that their continued lines seemed to resemble the coils of a gigantic serpent. During these manœuvres, the flapping of their many thousand wings causes a reverberation suggestive of distant thunder. Audubon states that in Kentucky, on the Green River, where the trees are of great magnitude, the Wild Pigeons came to roost, and occupied a space forty miles in length and about three in width. It had been occupied by them about a fortnight when he visited it. The dung was several inches in depth, covering the whole extent of the roosting-place. Many trees two feet in diameter had been broken down by their weight, as well as many branches of the tallest and largest trees. The forest seemed as if it had been swept by a tornado. The Wild Pigeon mates in pairs, though living in vast companies. Their nests are composed of a few dry twigs laid crosswise on the branches of trees. Audubon saw fifty to one hundred in the same tree. It occasionally breeds in confinement, and is susceptible of partial domestication. Wilson says: "Happening to go ashore, one charming afternoon, to purchase some milk at a house that stood near the river, and while talking with the people within doors, I was suddenly struck with astonishment at a loud, rushing roar, succeeded by instant darkness, which, on the first moment, I took for a tornado about to overwhelm the house and everything around in destruction. The people, observing my surprise, coolly said, 'It's only the Pigeons'; and, on running out, I beheld a flock thirty or forty yards in width sweeping along very low, between the house and the mountain. These continued passing for more than a quarter of an hour, and at length varied their bearing, so as to pass over the mountain, behind which they disappeared before the rear came up." The Wild Pigeon is sixteen inches long and twenty-four inches in extent.

WHITE-WINGED DOVE (*Melopelia leucoptera*).—This genus is represented by only one species. It is an inhabitant of the south-western parts of the States, extending to Arizona and Lower California. The general color is a fine ashy, with an olivaceous cast on upper surface, the middle tail feathers being decidedly brownish; occiput with a purplish tinge; a spot of black with steel-blue reflection below the ears; a large patch of white on the wing. The male has faint purplish-golden reflections on the sides of the neck. This is a very common species in Jamaica, living generally in the lowlands. It is often kept in confinement, and frequently breeds there.

ZENAIDA DOVE (*Zenaida amabalis*).—This Dove is found on the Florida Keys and the West Indies. Audubon found them plentiful at Indian Key, on the Florida Reef, where, he says, they arrive about the middle of April, and remain until October, when they return to the West Indies. These birds are like the Ground Doves in habit, spending most of the time on the ground. They are extremely gentle, and so tame that they can be approached very closely without exhibiting fear. Their notes are said to be much like those of the Carolina Dove, but softer and more tender. They have been propagated easily in this country and in England. As a cage-bird it becomes quite tame. Its color is, above, reddish-olive, variously glossed with gray; the top of the head and the under parts, violet-purplish-red, paler on the chin and throat; insides of wings and sides of body, blue; bill, black; feet, yellowish. Length, ten inches; wing, six; tail, four.

CAROLINA DOVE (*Zenaidura carolinensis*).—Called also the COMMON DOVE. Its locality is throughout the United States, from the Atlantic to the Pacific. It is migratory in the Northern States, reaching New England about the 1st of April. In some parts of the country it becomes partially domesticated. Its flight is rapid, and a peculiar whistling sound is observable when it is heard flapping its wings. In Louisiana it is called Ortolan. The Common Dove is twelve inches and a quarter long. Bill, black at the culmen; iris of the eye, dark brown.

SCALY DOVE (*Scardafella inca*).—This Dove inhabits the Rio Grande Valley, Arizona and Guatemala. There are two species only of this genus, one belonging to South America. The Scaly Dove breeds abundantly at Cape St. Lucas, the nest being constructed usually in a low tree or shrub.

GROUND DOVE (*Chamæpelia passerina*).—Common to the South Atlantic and Gulf Coasts; rarely as far north as Washington. It is also found in Southern and Lower California and in the West Indies, being confined mostly to the sea-coast. Audubon describes this bird as having a low, easy flight, accompanied by a whistling sound similar to other species. It is usually met with in groups of four or five, and seems to have a fondness for alighting on fences, though it moves among the trees and shrubbery easily. The ground is, however, its natural resort. In the vicinity of Charleston, S. C., it is seen during the whole year. The length of the Ground Dove is six inches and a quarter. Bill, yellow, black at the point; iris of the eye, orange-red.

KEY WEST PIGEON (*Oreopeleia martinica*).—This bird was observed by Audubon, and he considered Key West its only locality in the United States. It is common in the West Indies, and migrates to Key West in the spring or early summer. Their habits are similar to those of the Carolina Dove. They prefer dark, shady recesses of the forest, particularly near shady ponds. Since Audubon's time none of these birds have been found at Key West, though, according to that eminent ornithologist, they were at one time abundant there. The length is

nearly eleven inches; wing, six; tail, five and three-quarters. Another species of this genus, the Montana, or Mountain Dove, is found in South America. No other species is known of this genus.

BLUE-HEADED PIGEON (*Starnœnas cyanocephala*).—This is another West Indian bird, that visits Key West and some of the Florida Keys. Audubon met with one pair at Key West, but could not procure them. They seem to be much more shy and distrustful than some of the other species. This is the only species of the genus. In external appearance and manners it is thought to resemble the Quails. The Blue-headed Pigeon has a blue bill, with the fleshy part at the base carmine; iris, brown; scales of the feet carmine, the inter-spaces white; chin and throat black, with a narrow border of white below. Length, nearly eleven inches; wing, five and a half; tail, four and a quarter.

FAMILY—CRACIDÆ.

THE CURASSOWS.

TEXAS CHACALACCA (*Ortalida vetula*).—This bird is the only one of eighteen species of the genus that is found in the United States. It has somewhat the appearance of Wild Pigeon. The Chacalacca was first taken in the United States by Col. McCall, in Texas, who describes it as a very gallant and spirited bird, inhabiting the extensive forests of Chaparral, which envelop the Resaca de la Palma. Here, and for miles along the Rio Grande, it was abundant; and throughout this region the remarkable and sonorous cry of the male bird could not fail to attract and fix the attention of the most obtuse or listless wanderer who might chance to approach its abode. Its trivial name is given it by the Mexicans, which is probably derived from the cry of the bird. Its voice, in compass, is equal to that of the Guinea Fowl, and in harshness but little inferior. At sunrise these birds form a chorus with their harsh voices, which makes the forests ring again. Col. McCall adds that the volubility and singularity of its voice is its most striking and remarkable trait. The eye is said to be a remarkable feature, being full of animation and courage, equal to that of the Game Cock. It is frequently domesticated by the Mexicans, who esteem it for its fighting qualities. It is easily domesticated, and is sometimes crossed with a Game Fowl. The colors of this bird are brownish-olive; the head plumbeous, lighter beneath; eyes, brown; bill and feet, lead color. Length, twenty inches and a half; wing, eight and a half; tail, eleven.

FAMILY—MELEAGRIDÆ.

THE TURKEYS.

This family is entirely confined to North and Middle America, and is represented only by one genus, Meleagris. The species now living are only two. Three fossil species have been described, which indicates that the genus has been better represented. Two fossils were found in New Jersey, in the Post-Pliocene. One of them (the M. altus of *Marsh*) was taller than the Common Turkey. The other (M. celer, *Marsh*) was much smaller. The third species (M. antiquus, *Marsh*) lived at a still earlier date, its remains having been obtained in the Miocene beds of Colorado.

WILD TURKEY (*Meleagris gallopavo*)—Plate VII. fig. xvi.—This superb creature inhabits the eastern portion of the United States and Canada, reaching nearly to the Rocky Mountains, and south to the Gulf Coast. The Wild Turkey was formerly abundant in New England and the Northern Atlantic States, but the march of civilization has gradually pushed it westward, or, perhaps, has extinguished the race in those localities. In Franklin County, Mass., individuals have been shot within a few years. Along the rich bottoms of the Mississippi and the Missouri Rivers they are yet plentiful. They usually mate for one season, at least, though it is known that one male sometimes has more than one under his charge. Mr. Audubon states that the female is so devoted as to remain unmoved, even when he had approached near enough to reach her. They become partially tame when kept in confinement. Dr. Bachman states that they, when kept in confinement, separate from the domestic birds, lose the brilliancy of their color in the third generation, become of a pale brown, and have here and there an intermixture of white feathers. The male Turkey weighs from sixteen to thirty-five pounds. Its length is forty-eight to fifty inches; extent of wing, sixty inches; tail, eighteen and a half. The female is smaller, corresponding, in this respect, to most of the gallinaceous birds, and unlike many others, notably the birds of prey, where the female is much the largest. A Mexican variety is called M. gallopavo, variety mexicana. "This variety has the black subterminal zone of the tail with a more or less distinct metallic bronzing, which we have never seen in any specimens of the gallopavo."—*North American Birds.* This bird is regarded as the origin of our Domestic Turkey; while the more eastern, the gallopavo, is not. The habitat of this variety is given as "on the Rocky Mountains, from Western Texas to Arizona, and south along the Table-lands of Mexico."

FAMILY—TETRAONIDÆ.

THE GROUSE.

SPRUCE PARTRIDGE (*Canace canadensis*).—This bird is also called the CANADA GROUSE, and the SPOTTED or BLACK GROUSE. It is found in the spruce swamps of the North, extending to the Arctic Circle, and west nearly to the Rocky Mountains. Mr. Audubon met with numbers of them in Maine, in the vicinity of Eastport, in the tangled thickets of spruce and hackmatack. They were here breeding. In their movements they are said to resemble the Common Quail. While the female is sitting on her eggs, she will allow a very close approach to her nest without moving. Audubon says that they are, in some degree, weather guides, for when they go to roost early in the day there is sure to follow rough weather. This Grouse is sometimes kept in confine-

ment, and has been known to breed there. The length of this bird is about sixteen and a quarter inches; wing, six and three-quarters; tail, five and a half. The tail has sixteen feathers, with a broad, brownish-orange terminal band.

FRANKLIN'S GROUSE (*Canace canadensis; var. franklini*).—This variety is found on the Northern Rocky Mountains, near the United States boundary, and west to the Coast Range. The differences between these two are considerable, yet not enough to cause a separation. This species is similar to canadensis, but with the tail-feathers entirely black, without the terminal band of orange-brown. The upper tail-coverts are broadly tipped with white.

DUSKY GROUSE (*Canace obscurus; var. obscurus*). —This species is confined to the Rocky Mountain region, from Oregon to New Mexico. Dr. Newberry considers this as the handsomest of all the American birds of this family. Its flesh is white, and fully equal to the Ruffed Grouse or Quail. It is considered to be more related to the Ruffed Grouse in its habits than any other bird. This Grouse is rarely seen on the prairie, but frequents the dense spruce forests near the coast. It has remarkable powers of ventriloquism. When the bird is sitting on a limb above you, its voice seems to come from some remote place. A variety, called the fuliginosus, is found on the north-western coast, from Oregon to Sitka. In Oregon it is known as the Blue Grouse. The male of the Dusky Grouse has a peculiar call. It is said to be a prolonged sound, resembling the whirr of a rattan-cane moved rapidly through the air. This is repeated several times with considerable rapidity, and then stops for a brief interval. This is said to be produced by the alternate inflation and contraction of sacs, one on each side of the throat, which are usually concealed by the feathers, and are covered by an orange-colored, thick, corrugated skin. Another variety (the richardsoni) is found in the Rocky Mountain region of British America, and southward to the Yellowstone. The length of the Oregon Dusky Grouse is twenty inches; wing, eight and a half; tail, about six and a quarter.

SAGE COCK (*Centrocercus uraphasianus*). — This bird is considerably larger than the preceding species. Its habitat is the sage-plain of the North-west. Mr. Nuttall saw it in numbers on the north branch of the Platte. They were always on the ground, in small flocks or pairs, by no means shy; but when too nearly approached, utter a rather loud but short guttural chuckle, and rising with a strong, whirring sound. Like other Grouse, it is very unsuspicious, and is easily caught. Owing to the nature of their food—the sage—they are not edible. "At the mating season the male is said to select some small eminence on the banks of streams for the very singular performances it goes through with at that period in the presence of its mate. The wings are lowered and dragged on the ground, making a buzzing sound; the tail, somewhat erect, is spread like a fan; the bare and yellow esophagus is inflated to a prodigious size, and said to become nearly half as large as its body; while the silky, flexile feathers on the neck are erected. Assuming this grotesque form, the bird proceeds to display a singular variety of attitude, at the same time chanting a love-song in a confused and grating, but not an offensively disagreeable tone. In the winter these birds are said to be found in large flocks of several hundreds; in the spring, in pairs; and later in the summer and fall, in small family groups. They are abundant throughout the barren, arid plains of the Columbia and in Northern California, but were not met with east of the Rocky Mountains. Dr. Newberry regards this Grouse, when in full plumage, as rather a handsome bird, and much better looking than any figure of it he had seen. It is much the largest of American Grouse, weighing from five to six pounds. The male bird has a distinctive character in the spaces of bare, orange-colored skin which occupy the sides of the neck, and are usually concealed by the feathers, but may be inflated to a great size." — *North American Birds.* A very curious anatomical peculiarity is said to be found in this species: they have no gizzard, having instead a soft, membraneous stomach, rendering it impossible to digest any hard food. They are not known to eat grain of any kind, but feed mostly on artemesia, or wild sage, and grasshoppers. The length of the male is thirty-three inches; wing, thirteen; tail, thirteen.

SHARP-TAILED GROUSE (*Pediocætes phasianellus*). —This bird is found in British America, and westward in Alaska. "It frequents the open glades or low thickets on the borders of lakes, especially where the forests have been partially cleared; perching on trees in the winter, but keeping to the ground in summer, and at all seasons met with in small flocks of ten to sixteen. They are said, early in spring, to select some level place, where a covey meets every morning and runs round in a circle of about twenty feet in diameter, so that the grass is worn quite bare. If any one approaches this circle, the birds squat close to the ground; but, if not alarmed by a too near approach, they soon stretch out their necks to survey the intruder, and resume their circular course, some running to the right, and others to the left, meeting and crossing each other. These 'Partridge dances' are said to last a month or more, or until the female begins to incubate. This Grouse rises from the ground with the usual whirring noise, and alights again at a distance of a few hunderd yards, sometimes on the ground or the branches of a tree. In winter they hide in the snow, and make their way with ease through the loose drifts, feeding on the buds of the willows, larches, aspens, etc. In summer and autumn their food is principally berries. They are said to lay about thirteen eggs early in June, the nest being on the ground, formed with grasses lined with feathers." — *North American Birds.* Another variety (columbianus, the Columbia Sharp-tail) is found more to the southward. The plains and prairies of Wisconsin and Illinois abound with them. This bird is found much farther west than the Prairie Chicken, the latter being confined to the region east of the Mississippi Valley. This

Grouse is found in Northern Illinois and Southern Wisconsin. It is considered to be the best in flavor as a table delicacy, or at least to be unrivalled as such. It is about the size of the Pinnated Grouse. There seems to be no marked difference between the male and the female of this species. A striking peculiarity is seen in the two middle tail-feathers, which are two inches longer than the others.

PRAIRIE CHICKEN (*Cupidonia cupido*)—Plate VII, fig. xiv—is the only species known to the genus. Its present habitat is the prairies of the Mississippi Valley, from Louisiana northward; east to Pocono Mountains, Pennsylvania. They were formerly common in Massachusetts, and some are yet seen on the island of Martha's Vineyard. "In the earliest days of spring, even when the snow is yet on the ground, these birds no longer keep in large flocks, but separate into smaller parties, and the mating season commences, during which their manners—especially those of the male—are very peculiar and striking. A particular locality is selected, to which they resort until incubation has commenced. The males meet in this place and engage in furious battle. At this season they are especially conspicuous for their great pomposity of bearing. With tails outspread, and inclined forward to meet the expanded feathers of their neck, and with the globular, orange-colored, bladder-like receptacles of air on their necks distended to their utmost capacity, and issuing a peculiar sound, spoken of as *booming*, these birds strut about in the presence of one another, with various manifestations of jealous dislike and animosity, soon ending in furious contests. Their wings are declined, like those of the Cock Turkey, and rustle on the ground as the birds pass and repass in a rapid manner; their bodies are depressed, and their notes indicate their intense excitement. Upon the appearance of a female answering to their calls, they at once engage in their desperate encounters. They rise in the air and strike at one another, in the manner of a Game Cock, and several engage in a miscellaneous scrimmage, until the weaker give way, and, one after another, seek refuge in the neighboring bushes, the few remaining victors discontinuing their contests as if from sheer exhaustion."—*North American Birds.* A variety (pallidicinctus) is found on the south-western prairies, in Texas.

RUFFED GROUSE (*Bonassa umbellus*)—Plate VII, fig. xiii.—This is one of the most familiar birds in the Northern States. In New England it is called Partridge; in the Middle and Southern States, Pheasant; and in the British Provinces, Birch Partridge. There are several varieties found in various parts of the continent, but the present is confined to the eastern province of North America. It is a constant resident where it is found, and is not migratory. They feed at times on the buds of the birch and other trees, and in the summer on berries in great variety. This Grouse is said to be more or less polygamous. The males only remain with the females until incubation has commenced, and then keep by themselves. Dr. Brewer, in *North American Birds*, relates a pleasant instance of the devotion of the female to her young. He says: "Coming suddenly upon a young brood of Partridges, squatted with their mother near a roadside in a wood, my first knowledge of their presence was received from the old bird flying directly at my face, and then tumbling about at my feet with frantic manifestations of distress and imitated lameness. In the meanwhile, the little ones scattered in every direction, and were not to be found. As soon as she was satisfied of their safety, the parent flew to a short distance, and I soon heard her clucking call to them to come to her again. Altogether, it was one of the most striking scenes of parental devotion and well-managed intervention I ever witnessed. When I came upon the mother, she had squatted upon the ground, and the young had taken refuge under her wings." The peculiar drumming of these birds—the males—is said to be produced by a rapid vibration of its wings against its body. The male bird chooses with great constancy the same log or rock, whereon to perform his affectionate addresses. The season for this is early in March. He struts about, with wings lowered, neck elevated, and rapidly beats the sides of his body with his stiffened wings. So rapidly does this beating take place, the sound seems to be at last continuous. In the Rocky Mountains, and as far north-west as Alaska, is a variety called umbelloides. They are somewhat smaller than umbellus, have a much grayer plumage and a shorter ruffle. Another variety (the sabini, called also the Oregon Grouse) is found on the coast mountains of Oregon, Washington and British Columbia. The flesh of the Ruffed Grouse is considered a great delicacy, especially in the fall, when they feed on the spruce buds and partridge berries, a peculiar flavor being imparted to them. The strong resemblance of the plumage of this bird to the lichen-covered branches of forest trees, renders it comparatively safe while squatting closely upon a limb. The length of the B. umbellus is eighteen inches; wing, seven and a quarter; tail, seven. The female is smaller.

WILLOW GROUSE (*Lagopus albus*).—This is also called the WHITE PTARMIGAN. Its habitat is in Arctic America, from Newfoundland to Sitka. The entire plumage, except the tail, of this bird in winter is pure white; the tail is black, with a white tip. These birds are very abundant in their northern haunts, and in winter they are pushed by the severity of the climate towards Canada, when our markets occasionally exhibit specimens for sale. In winter the food of the White Ptarmigan consists wholly of the buds of the willow. Well-worn paths among the willows are observed, which they constantly use in their rounds while feeding. The Indians take advantage of this habit to snare them. In the fall these Ptarmigans assemble in large flocks, separating somewhat in winter. The males are said to crow after the fashion of the Moor-cock of Scotland, the tone and notes being similar.

ROCK PTARMIGAN (*Lagopus mutus; var. rupestris*).—This is another Arctic bird, about the size of the last-named, though not so stout. Its habits are said to be much like those of the white species.

They are very numerous at the two extremes of Hudson's Bay. Like the preceding, it is white in winter.

WHITE-TAILED PTARMIGAN (*Lagopus leucurus*).—This is a north-western species, inhabiting the alpine summits of the western mountains, and along the cascades of Oregon, Washington and British Columbia. Its color in winter is pure white, having no black upon the tail, as in the other species. Like several other species, this bird exhibits a singularly mottled appearance between the extremes of winter and summer plumage, the full summer dress being of a grayish-white and ashy-buff, sprinkled with black.

FAMILY—PERDICIDÆ.

THE PARTRIDGES.

Birds of this family, unlike the Grouse, have naked legs and bare nasal fossæ. They are much smaller, and the species are much more numerous. They have a wide distribution, being found in almost any quarter of the globe.

BOB-WHITE; QUAIL; PARTRIDGE (*Ortyx virginianus.*)—Plate VI, fig. xi.—This most familiar bird is found in the Eastern United States, and as far west as the High Central Plains; southward to Texas. In Maine, however, it is a stranger, if, indeed, it is ever found there. In New Hampshire and Vermont it is rare. The severity of the winters and much hunting have very materially lessened its numbers in Massachusetts. They are not migratory, but remain in the neighborhood where they are reared. The severe winters affect them seriously at times, when, during a fall of snow, they huddle together and allow themselves to be buried for a while. If the snow is light they easily manage to thrust through it, but they are occasionally kept fast by the freezing of the surface, when they perish from hunger. They are sometimes found in this position in large numbers. Bob-white is always found in open grounds, or nearly so, near the edge of woods. Its food consists largely of the seeds of various plants, berries, etc. Later in the season it feeds on grasshoppers. In country villages it often becomes quite tame, and ventures near the farmyards to eat with the poultry. In the Central Park, New York, it is frequently heard uttering its peculiar note, *Bob-white! bob-white!* We have frequently heard this note in low ground within a few rods of the grand Fifth Avenue entrance to the park—the Scholars' Gate, so-called. In the interior towns of Massachusetts this note is interpreted *More-wet! more-wet!* and the farmer considers his note to be a precursor of rain. It has two broods in a season, the male taking charge of the first brood when they are about half grown. The male is exceedingly devoted and courageous. Dr. Brewer relates that he once came upon a covey of young Quail feeding on blue-berries, directly in the path. They did not see him until he was close upon them, when the old bird, a fine old male, flew directly towards him and tumbled at his feet, as if in a dying condition, giving at the same time a shrill whistle, expressive of intense alarm. At this moment the bird could have been easily caught. The young birds, at the cry of the parent, flew in all directions, and the male soon followed them, and began calling in a low cluck, like the cry of the Brown Thrasher. These young were hardly a week old, yet they seemed to fly well for a short distance. In view of the inappropriate name our bird has obtained—Quail—Prof. Baird has proposed the familiar title Bob-white. It is now generally understood among naturalists and sportsmen that this shall be recognized as the name of our species in all parts of the country where it is found.

PLUMED PARTRIDGE (*Oreortyx pictus*).—This bird, called also the MOUNTAIN PARTRIDGE, inhabits the mountain ridges of California and Oregon, towards the coast. The Mountain Partridge, according to Dr. Newberry, is similar in some respects to the Common Partridge of Europe. They are usually found in the chaparral, where they readily escape by running and hiding, seldom rising on the wing. This species appears to be easily tamed and domesticated. The call-note is said to be almost exactly like that of the Hen-turkey. The male, instead of a whistling note, like that of the Bob-white, has a crowing sound, like *koo-koo-hoóe!* The eggs of this species are similar, in general shape, to the preceding, having the pointed and the very obtuse ends respectively. They are of a very rich cream color, with a reddish shading, and unspotted. The female is like the male, with the exception that the crest is shorter.

CALIFORNIA QUAIL (*Lophortyx californicus*)—Plate VI. fig. xii.—This beautiful species inhabits the valley portions and foot-hills of the Pacific Province of the United States, reaching southward to Cape St. Lucas. Like the preceding species, this is richly marked in plumage, and has two pompon-like crests, jet-black in color, which stand erect upon the occiput. The female is similar, with a shorter crest. It is called the Valley Quail in California, to distinguish it from the Mountain Quail, its habits leading it more into the prairies and low grounds near river banks. Dr. Newberry describes its note as rather harsh and disagreeable, somewhat resembling that of the Woodpeckers. The cry is represented, he says, by the syllables *kŭck-kŭck-kŭck-kà!* the first three notes being rapidly repeated, the last prolonged, with a falling inflection. As a game bird, it is regarded as inferior to Bob-white. It is easily domesticated.

GAMBEL'S QUAIL (*Lophortyx gambeli*).—The habitat of this bird is given as in the Colorado Valley; north to Southern Utah, and east to Western Texas. It has the beautiful black crest of the preceding species. Like the other species, it is easily domesticated. "This Quail is said to have three distinct notes—the common cry, uttered on all occasions of alarm, or to call the bevy together, which is a single mellow, clear *chink*, with a metallic resonance, repeated an indefinite number of times; then a clear, loud, energetic whistle, resembling the syllables *killink-killink!* chiefly heard during the pairing season, and is analogous to the *bob-white* of the

Common Quail; the third is its love-song, than which, Dr. Coues adds, nothing more unmusical can well be imagined. It is uttered by the male, and only when the female is incubating. This song is poured forth both at sunrise and at sunset, from some topmost twig near the spot where his mate is sitting; and with outstretched neck, drooping wings and plume negligently dangling, he gives utterance to his odd, guttural, energetic notes."—*North American Birds.* The eggs are a cream-white color, beautifully marked with ragged spots of deep chestnut.

SCALED, OR BLUE PARTRIDGE (*Callipepla squamata*).—This, the only species of the genus within the United States, is found in the Table-lands of Mexico and the Valley of the Rio Grande. They are found often on the open plains, associated occasionally with the Texas Quail, and sometimes inhabit the Prairie-dog villages. It is a rare bird in collections, and an exceedingly shy one in its native localities. It has the reputation of being the swiftest of foot of any other Quail, trusting always to its fleetness on foot rather than flight by the wing. A Mexican naturalist attempted to domesticate some of this species, but failed completely. It seemed impossible to gain them over from their intractable, wild state. They are said to have a peculiar note, resembling that of a squirrel. The head is decorated with a full, broad, flattened crest of soft, elongated feathers. The size is the same as that of the other forms.

MASSENA PARTRIDGE (*Cyrtonix massena*).—The habitat of this Partridge is on the Rio Grande, in Arizona and Northern Mexico. It is sometimes seen associated with the Texas Quail. The Mexican naturalist, Don Pablo de la Llave, furnishes the following account of the habits of this bird: "It is only a few days since the third species has been brought to me. It is rather smaller than the former (C. squamata), and its deportment is entirely different. It carries its head habitually resting on its shoulders, the neck being excessively small and deflexed; and in everything it shows an amiability and, so to speak, kindness of character [*una bondad de caracter*] which is not found in any other species of this genus; and it is naturally so tame and domestic as to permit itself to be caught by the hand. These birds are always united, forming a covey, and whenever one is separated, the others follow it. They do not, like others, wish to sleep on elevated places, but sit on the ground, drawing very near together. Their notes, which are not varied, are very low and soft, and I have never heard loud cries from the male. When they are frightened they show much activity and swiftness; at other times their gait and movement are habitually slow and deliberate, carrying the crest puffed up [*espayada*]."

WADING BIRDS.

THE *Limicolæ*, or Shore-birds, are represented by all kinds of Plover, Snipe, Woodcock, the Phalaropes, Avocets, Stilts, Turnstones and Oyster-catchers.

FAMILY—CHARADRIIDÆ.

PLOVER.

There are other birds, frequenting the uplands as well as lowlands, which the sportsman or others unskilled call Plovers. The Upland Plover, so-called, is one. The true Plover has only three toes, and is particularly noticeable as having a short and stout bill. One exception to this rule only is seen among American birds — the Bull-head or Black-bellied Plover (*Squatarola helvetica*), in which there is a rudimentary hind-toe. Another bird—the Aphriza virgata of the Pacific Coast—has a well-developed hind-toe; but it is thought that its place is with the *Scolopacidæ* possibly. The only three-toed American bird of the *Scolopacidæ* now recognized is the Stilt (*Himantopus nigricallis*).

BLACK-BELLIED PLOVER (*Squatarola helvetica*)—Plate 23, fig. 89.—This bird is known in some parts of the country as the Whistling Field Plover. It is particularly attached to ploughed fields, where it forms its nest of a few coarse materials, slightly put together. The female has frequently two broods in a season, laying four large eggs of a light olive, dashed with black. It is an extremely shy and watchful bird, though clamorous during breeding-time. About September it resorts to the sea-shore, joining the multitudes of shore-birds which are passing in migration. At this season it is said to be abundant on Long Island, feeding on the great plains. It has a loud, whistling note, and from certain resemblances the gunners call them Black-bellied Killdeer. This bird resembles somewhat the Golden Plover, but is larger, and the presence of the small hind-toe readily distinguishes it.

AMERICAN GOLDEN PLOVER (*Charadrius fulvus; var. virginicus*)—Plate 23, fig. 88.—This bird is now considered distinct from the European (the C. apricarius.) It is distinguished by the ashen-gray of the inner surface of the wings, the latter being white. The C. fulvus of Asia is nearer. The Golden Plover is met with on all parts of our coast, but is never plentiful, and is never seen in the interior. Dr. Coues met with it on the Pacific Coast in considerable numbers, and says that it migrates in great numbers through Dakota. They were seen in company with the "Tattlers and Esquimaux Curlews, and were quite tame," running rapidly and lightly in search of food; flew with a mellow, whistling note, and settled again with a momentary graceful poise of the upturned wing."

KILLDEER PLOVER (*Ægialitis vociferus*).—This is a very familiar bird in all parts of the United States. Its peculiar note, *killdeer! killdeer!* is uttered as it plunges and courses in the air, and at times of breeding, when running and counterfeiting

lameness. It resembles, in the latter habit, the Lapwing of Europe. Its cries are heard even after dark, or on moonlight nights. It is one of the few birds of this group that breed in all parts of the United States. Though so familiar in all localities, yet it migrates extensively, being seen as far south as South America.

RING PLOVER (*Ægialitis semipalmatus*).— The "Ring-neck," or Semi-palmated Plover, like many other American birds, is closely like the European, though distinguished by a greater extent of basal web between the toes, which gives the trivial name to this species. It is common in all parts of the United States, migrating as far south as Brazil, and in summer is found in Greenland. It has a sharp, twittering note, says Wilson, peculiarly soft and musical, resembling the tone of a German flute, which it utters when running along the sand, with expanded tail and hanging wings, endeavoring to decoy you from her nest. In the Middle States it is chiefly a bird of passage, breeding in higher latitudes. In Labrador it breeds in great numbers.

PIPING PLOVER (*Ægialitis melodus*).—The Ring Plover is also a name given to this bird in some sections. It is common to all parts of the United States and British Provinces east of the Rocky Mountains, and is particularly abundant on the Atlantic Coast. It breeds in the northern portions, and winters in the Carolinas southward to Cuba and Jamaica. The Piping Plover does not breed in high northern latitudes, being only seen about the borders of Canada and the States, especially on the Atlantic Coast. Dr. Coues thinks that some breed as far south as the Carolinas.

WILSON'S PLOVER (*Ægialitis wilsonius*).— This Plover is confined to the eastern and southern portions of North America, and the same on the coast of South America. It is readily recognized by its long and stout bill and short tail. It is about seven and three-quarter inches long and fifteen and a half in alar extent. Its front is broad and white, bounded by a widish band of black; the lores also black; the legs and feet are flesh-colored; the claws, black; the bill is black and stout, an inch long, the upper mandible projecting. Ægialitis nivosa is a species rather smaller than the present, and is peculiar to the coast of California. Æ. microrhyncha is another California species, found by Mr. Ridgway, and described by him in *Am. Naturalist, vol. viii*, 1874.

MOUNTAIN PLOVER (*Eudromias montanus*).— This is one of the strictly western species. Its eastern limit, as far as known, is Middle Kansas. Northward it goes as far as Canada line, and southward to Texas. Its name is not well chosen, as it equally visits the plains and mountains. It is peculiar in resorting to dry and arid plains, being in this respect different from the others that frequent the sea-shore and river-side. Dr. Coues found it in New Mexico late in June, associated with the Curlews, and thinks it breeds there. "They were not difficult of approach, and were seen in large flocks. When disturbed, they dipped the head, ran rapidly a few steps in a light, easy way, and then stopped abruptly, drawing themselves up to their full height, and looking around with timid yet unsuspicious glances. Their notes are rather peculiar, as compared with those of our other Plovers, and vary a good deal according to circumstances. When feeding at leisure, and no way apprehensive of danger, they utter a low and rather pleasing whistle, though in a somewhat drawling or lisping tone; but the note changes to a louder and higher one, sometimes sounding harshly. When forced to fly by persistent annoyance, they rise rapidly, with quick wing-beats, and then proceed with alternate sailing and flapping, during the former action holding the wings decurved. They generally fly low over the ground. They then either squat low, in hopes of hiding, or stand on tip-toe, as it were, for a better view of what alarmed them. They are mostly insect-eaters."

FAMILY—HÆMATOPODIDÆ.

THE TURNSTONES.

THE TURNSTONE (*Strepsilas interpres*) is a solitary species, and one known to all parts of the world. It is probably the most widely distributed of any bird. Its trivial name is derived from the circumstance that it has the habit of turning over small stones to reach its food, which consists of the crustaceans that lurk beneath them in tide-pools. This bird is about nine inches in length, with a wing of six inches' in extent. Nuttall regards it as solitary and wild by nature, coursing the shore in pairs, or in small parties, which have bred together. In May and June it feeds almost exclusively on the spawn of the Limulus, or Horse-shoe Crab, which it finds at that time on the sands of the coast of New Jersey. Its note is loud and twittering, emitted while flying or running; at the same time its wings are lowered. Audubon describes with considerable minuteness the method adopted by the Turnstone to overturn the oyster-shells and stones for its food. The bill of the bird is curved upwards slightly, like a lever adapted to the purpose. When the bill proves too feeble, the breast of the bird is pressed upon the object and loosened previous to its removal. A species is found in the western portions of North America, which has been named the BLACK TURNSTONE (S. melanocephalus). It is the same in size, but has a dark head, breast and upper parts. Local names are Brant-bird and Calico-back.

THE OYSTER-CATCHER (*Hæmatopus palliatus*)— Plate 23, fig. 90—is common to all the Atlantic States, and probably is along the Pacific Coast. It is a fine, large bird, measuring seventeen and one-half inches in length, with a spread of wing equal to ten inches. Its bill is long, straight and flattened; the tail short. The sexes are alike externally. Nuttall describes two kinds, and speaks of the present as the Pied Oyster-catcher, and of its identity with the European species. The two are, however, distinct. This bird is rarely seen above Long Island Sound, and is more at home south of Cape Hatteras. About the last of April it is seen in pairs or in small parties on the

Jersey sands. The note is a quick, loud and shrill whistling, as *'Wheep! wheep! wheo!* and *Peep! peep!* repeated on the wing as well as while at rest. The name Hæmatopus indicates its bloody-looking feet, which are quite red; but the name only holds good for one species, while others have pink or light-colored feet.

BLACK OYSTER-CATCHER (*H. ater*).—Audubon gives this species a habitation in the United States, but authors do not recognize it as yet. It was described by the former as H. townsendi. It is found in South America, and if in North America at all, on the western coast.

BACHMAN'S OYSTER-CATCHER (*H. niger*).—This is a little smaller than the first-named species. It is known on the western coast, and, according to Pallas, is found in North-eastern Asia.

FAMILY—RECURVIROSTRIDÆ.

THE AVOCETS.

AVOCET (*Recurvirostra americana*) — Plate 27, fig. 102.—The STILT-BIRD, so called from its enormously elongated legs, is found in all parts of temperate North America, though more common in certain portions. In New England it is not a familiar bird. It is most abundant in the Mississippi Valley, and northward to the Rocky Mountains. Wilson says: "From its perpetual clamor and flippancy of tongue, it is called in New Jersey the *Lawyer*." He found it here associated with the Black-necked Stilt, on the salt marshes, where it was breeding, on the 20th of May. It flew around the pools exactly like the Long-legs, uttering a *click! click! click!*—a sharp note—alighting on the marsh or in the water indiscriminately, fluttering its loose wings and shaking its half-bent legs, as if it was ready to tumble over, keeping up a continual yelping note.

BLACK-NECKED STILT (*Himantopus nigricollis*).—This bird is found in nearly all parts of the United States, and as far south as Brazil. The habits are well described by Dr. Coues, who observed the species in great numbers in New Mexico. In the shallow *lagunas*, where they evidently breed, were flocks of twenty or thirty, very closely associated. The wings are very long and pointed, as well as ample in width; its flight, in consequence, is firm, vigorous and swift. When folded they reach beyond the tip of the tail, and as the under coverts reach to the end, the bird tapers off behind to a fine point. On the ground, whether walking or wading, the bird moves gracefully, with measured steps. The long legs are much bent at each step—(only at the joint, however!)—and planted firmly, perfectly straight. Except under certain circumstances, as those Wilson relates, there is nothing vacillating, feeble or unsteady either in the attitudes or movements of the bird.

FAMILY—PHALAROPODIDÆ.

THE PHALAROPES.

The Phalaropes are Sandpiper-like birds, with lobed feet, the toes being provided with expansions on each side that render them useful in swimming. In shape and effect they are little oars. The under plumage is thick and duck-like, fitted to shed the water. They are all elegant in form and graceful in movement. The family is small, not more than three species in number, and those are all found in this country. Wilson's Phalarope appears to be the only one exclusively American; the other two belong to both continents.

WILSON'S PHALAROPE (*Steganopus wilsoni*).—This species inhabits this continent generally; rarely in the Eastern States; common in the Mississippi Valley and westward. It breeds in the Western United States and in the interior of the fur countries in the lower latitudes. In winter it reaches South America. Wilson's Phalarope is considered the handsomest of the wading birds. It is largest of the group. The Phalarope is fond of the interior rather than the ocean border, frequenting the fresh-water ponds and streams.

NORTHERN PHALAROPE (*Lobipes hyperboreus*).—This is a more maritime species than the latter, inhabiting the whole continent, and breeding far north; spending the winter in the tropics. On the New England Coast it is more abundant, and of regular appearance during the migrations, some breeding probably in the Bay of Fundy.

RED PHALAROPE (*Phalaropus fulcarius*).—This species inhabits the same localities as the preceding. The eggs are so nearly like the others they cannot be distinguished.

FAMILY—SCOLOPACIDÆ.

THE SNIPE.

This family, members of which are called as belonging to the "Long-billed fraternity," includes numerous species. They are distinguished from the Plovers by the slenderness of the bill and by its great length.

AMERICAN WOODCOCK (*Philohela minor*).—The habitat of this bird is the Eastern United States and the Provinces north to Nova Scotia, west to Kansas and Nebraska. The European Woodcock (Scolopax) is said to occasionally straggle into the limits of our country. The larger specimens, which are sometimes exhibited by sportsmen, are probably of this species, as undoubted examples are extant. Audubon gives the following interesting account of the habits of the American Woodcock: "In the breeding season its curious spiral gyrations, while ascending or descending along a space of fifty or more yards of height, when it utters a note somewhat resembling the word *kwank*, are performed every evening and morning for nearly a fortnight. When on the ground, at this season, as well as in autumn, the male not unfrequently repeats this sound, as if he were calling to others in his neighborhood; and, on hearing it answered, he immediately flies to meet the other bird, which in the same manner advances to meet him." Most of these birds migrate, leaving for the South in October, and returning to us in March. It begins to lay in April. The nest is placed on the ground, generally in a retired spot,

near an old trunk, perhaps, formed of a few withered leaves and stalks of grass. The eggs are four, sometimes five, about an inch and a half long. It is bluntly rounded—very different from those of the other members of the family. The Woodcock is properly a nocturnal bird, feeding at night mostly. At such times, as well as in early morning, he rises, by a kind of spiral course, to a considerable height in the air, uttering at times a sudden *quack*, till, having gained his utmost height, he hovers around in a wild, irregular manner, making a sort of murmuring sound, then descends rapidly as he rose. When uttering his common note on the ground, he seems to do it with difficulty, throwing his head towards the earth, and frequently jetting up his tail. These notes and manœuvres are most usual in spring, and are the call of the male to his favorite mate. The flesh is, as is generally known, highly esteemed. In general figure and manners this bird resembles the European species, but it is considerably less in size, and is differently marked. It also has the first three quills of the wing very narrow and scythe-shaped.

AMERICAN SNIPE (*Gallinago wilsoni*).—This bird inhabits the whole continent, and a portion of the southern. It is sometimes called WILSON'S SNIPE, and also ENGLISH SNIPE. The latter term is entirely a misnomer, as the species is different from that of Europe. JACK SNIPE is another unnecessary appellation that has become attached to this bird. Wilson says that this bird has the same soaring, irregular flight in the air, in gloomy weather, as the Snipe of Europe; the same bleating note and occasional rapid descent; springs from the marshes with the same feeble *squeak;* and in every respect resembles the Common Snipe of Britain, except in being about an inch less, and in having sixteen feathers in the tail, instead of fourteen. The Snipe is eleven inches in length and seventeen inches in extent; the bill is more than two inches and a half long.

REDBREASTED SNIPE (*Macrorhamphus griseus*).—Called also GRAY SNIPE, BROWN-BACK and DOWITCHER. Its habitat is the whole of North America and a portion of South America. It is also frequently seen in Europe. Its size is about that of Wilson's; the bill is exactly like that of the latter. The distinguishing marks are a greater length of legs, a web between the outer and middle toes, by twelve instead of sixteen tail feathers, and various marks in coloration. The length is from ten and a quarter to twelve and a half; extent of wing, seventeen and a half to twenty and a quarter. Wilson's description is so good that we give it here: "It flies very rapidly, sometimes wheeling, coursing and doubling along the surface of the marshes; then shooting high in the air; then separating and forming in various bodies, uttering a kind of quivering whistle. During its stay on the sea-coast of New Jersey, it flies in flocks, sometimes very high, and then has a loud and shrill whistle, making many evolutions over the marshes—forming, dividing and re-uniting. They sometimes settle in such numbers, and so close together, that eighty-five have been shot at one discharge of the musket. They spring from the marshes with a loud, twirling whistle, generally rising high, and making several circuitous manœuvres in air before they descend. They frequent the mud-flats and sand-bars at low water, in search of food, and being less suspicious of a boat than of a person on shore, are easily approached." Dr. Coues says of this species: "They are gentle and unsuspicious creatures by nature, most sociably disposed to its own kind, as well as towards its relatives among the Ducks and Waders. Being partly web-footed, they swim tolerably well for a little distance, in any emergency. On such occasions, they swim with a curious bobbing motion of the head and corresponding jerking of the tail, to a hiding-place in the rank grass across the pool. Their movements are graceful and their attitudes are beautifully statuesque."

STILT SANDPIPER (*Micropalama himantopus*).—This bird is found in North America generally, but not west of the Rocky Mountains. It is a rare bird, breeding in high latitudes.

SEMI-PALMATED SANDPIPER (*Ereunetes pusillas*).—The habitat of this species is the whole northern and a portion of the southern continent. It is abundant and well known on our Atlantic shores. It is one of the smallest of its tribe. Though properly a sea-shore bird, it is seen at times on the borders of the inland lakes and rivers. Its length is six inches, and extent of wing twelve. The bill is black, an inch in length, and very slightly bent. The males and females are alike in color.

LEAST SANDPIPER (*Tringa minutilla*).—This little bird is found in every part of the western continent and the adjacent islands, and is occasionally seen in Europe, and is universally known as "Peep." Wilson says of it: "It is migratory, departing early in October for the South. It resides chiefly among the sea-marshes, and feeds among the mud at low water; springs with an irregular flight and a feeble *twit.* It is not altogether confined to the neighborhood of the sea, for I have found several of them on the shores of the Schuylkill, in the month of August." Its length is five inches and a half; extent of wing, eleven inches.

BAIRD'S SANDPIPER (*Tringa bairdi*).—This bird has only lately been recognized. Specimens were found in Arctic America and in Alaska, where it breeds. It is found in the interior of North America, east of the Rocky Mountains. It has been considered as a stranger to the Atlantic Coast, though one specimen has been captured there recently. Dr. Coues met with it in Dakota, in August, associated with the Redbreasted Snipe and Wilson's Phalarope.

PECTORAL SANDPIPER (*Tringa maculata*).—This well-known bird is common to the whole continent, and is also found in Europe, and is called JACK SNIPE and GRASS SNIPE in all places. It is game-like in habits, and, consequently, in request for the sportsman. Dr. Coues says it is a very abundant bird in summer in Labrador, where it frequents low, muddy flats. When they arise from the grass to alight

again at a little distance, they fly in silence, or with a single *tweet*, holding the wings deeply incurved; but when suddenly startled and much alarmed, they spring quickly, with loud, repeated cries, and make off in a zig-zag, much like the Common Snipe. Sometimes, gaining a considerable elevation, they circle for several minutes in silence over head, flying with great velocity—perhaps to pitch down again nearly perpendicularly to the same spot they start from. The southward migration begins in August, and is usually completed by the following month. A form found on Long Island has been called Cooper's Sandpiper, but is so closely like the present, doubts are entertained concerning its validity.

BONAPARTE'S SANDPIPER (*Tringa bonapartei*) is known to all parts of the northern continent east of the Rocky Mountains. It breeds in the far north; migrating through the eastern province of the States, and wintering in the South. It is called also the WHITE-RUMPED SANDPIPER. Dr. Coues found this bird migrating northward in flocks in May, on the Republican Fork of the Kansas River. It is abundant along the whole of the Atlantic Coast to Florida. It has the same soft, low *tweet* that many others of this group have. It is distinguished at a distance by its white upper tail coverts.

PURPLE SANDPIPER (*Tringa maritima*).—This species is distributed over the northern continent, but is rather partial to the coast. It breeds very far to the north, visiting the New England coast in autumn, winter and spring, inclining rather to frequent the rocky beaches where the sea-weeds afford food in the great variety of marine life.

AMERICAN DUNLIN (*Tringa alpina*).—This bird is called also the BLACK-BELLIED and the RED-BACKED SANDPIPER. Its habitat is North America, particularly coastwise. It migrates and winters in the States, breeding in high latitudes only. Mr. Allen found this bird in Leavenworth. Wilson says the common name along the coast is Gray-back, and that it is a particular favorite with the gunners. They associate in small flocks, alighting in a close body together on the sand-flats, where they find small mollusca to feed upon. They are less timid than others, and on the approach of the sportsman they stand unconcernedly for a time. In November they leave for the South. It is ten inches in length, and twenty in extent of wing. Bill is black, and is about an inch and a half long; eye is small and black. The sexes are alike in general appearance.

RED-BREASTED SANDPIPER (*Tringa canutus*).—This bird—called also the KNOT, ROBIN SNIPE, GRAY-BACK and ASH-COLORED SANDPIPER—is found in Australia, South America and New Zealand, as well as on our shores. Though common on our coast, it is rare in the interior. Its breeding-places are far out of our limits.

SANDERLING; RUDDY PLOVER (*Calidris arenaria*).—This bird is about eight inches in length, the extent of wing being fourteen inches. It visits Massachusetts during the later weeks of the summer, after the breeding season in the extreme north. A little later the flocks are seen on the coast of New Jersey, and here they remain throughout the winter, feeding on the minute shell-fish and crustacea of the beaches. They utter a plaintive whistle while thus engaged, chasing back and forth, as the waves rise and fall, to get the last fresh morsels. They are abundant on the coast generally.

GREAT MARBLED GODWIT (*Limosa fedoa*).—The Godwit inhabits the entire temperate portion of North America and Central South America and the West Indies. It breeds in the Missouri and Upper Mississippi regions, and winters in the Southern States and southward. It is called by the gunners the Straight-billed Curlew, and by others the Red Curlew. Wilson says it is a shy and cautious bird, and so strongly attached to one another, that when one is wounded, the rest are at once drawn to the spot by sympathy, and continue circling around over the dead or wounded companion. They are readily enticed within gunshot by the sportsman's call. They associate with the Curlews, but are less numerous than the latter. The Godwits are especially fond of the salt marshes. The male is nineteen inches in length, and thirty-four inches in extent of wing; the bill is nearly six inches in length, turned up slightly towards its tip.

HUDSONIAN, OR BLACK-TAILED GODWIT (*Limosa hudsonica*).—The range of this bird is through the northern and eastern portions of the continent, and extends southward to West Indies and South America. It is not seen west of the Rocky Mountains, yet is rare on the Atlantic Coast. It breeds far northward. The White-tailed Godwit, a European species, has lately been seen in Alaska.

WILLET, OR STONE SNIPE (*Totanus semipalmatus*).—This is a beautiful bird, but a noisy one, making the shrill reiterations, says Wilson, of *Pill-will-willet! pill-will-willet!* almost incessantly along the marshes, being heard at the distance of half a mile. They are distributed very widely on our continent, but are more common on the sea-coast, breeding in the United States. The nest is near the water, or on marshy ground, rudely constructed of the simplest material, elevated slightly, and having but a trifling hollow to receive the eggs. Wilson says: "The anxiety and affection manifested by these birds is truly interesting. When disturbed from their young, they sail around and vociferate with great violence their common cry of *Pill-will-willet!* and uttering at times a loud, clicking noise. As they occasionally alight and slowly shut their long, white wings, speckled with black, they have a mournful note, expressive of great tenderness." The Willet swims well, and has the habit of wading more than other birds of this nature. Its length is fifteen inches, and alar extent thirty inches. The female is generally larger than the male.

TATTLER, OR TELL-TALE (*Totanus melanoleucus*).—This is also called the GREATER YELLOW-SHANKS, STONE SNIPE, and GREATER TATTLER, and inhabits the western hemisphere generally. It is usually seen in the United States in winter, being then very abundant. It breeds in high latitudes. The eggs are a dingy-white, irregularly marked with black. The Greater Tell-tale is so named by the gunners because

it has the inconvenient habit of whistling with an exceedingly shrill voice whenever any unusual noise or movement is observed by it. This is particularly annoying to sportsmen, when lying for Ducks. It frequents watery bogs and marshes on the coast, and farther inland. It has the habit of flying to great height, at times reaching the fresh-water streams and ponds, uttering its sharp note at such times, which can be distinctly heard even when the bird cannot be seen. The female differs very little from the male, in plumage. The male is fourteen and a half inches in length, and twenty-five inches in extent of wing. The bill is two inches and a quarter long, of a dark corn color, slightly bent upwards.

LESSER TELL-TALE (*Totanus flavipes*)—also called LESSER YELLOW-SHANKS—inhabits the western hemisphere generally, breeding in the Northern States and northwards. Many are seen wintering in the Southern States. It is found associated with the preceding, and equally abundant. Great numbers of these birds are procured on the Eastern Atlantic Coast, and brought to the markets of Boston, Philadelphia and New York, particularly in the autumn. Wilson says: "They have a sharp whistle of three or four notes, when about to take wing, and when flying. They have the habit of flying around their wounded companions, and sportsmen take advantage of this to procure numbers of them from the same flock." The length is ten inches, and extent of wing, twenty. The bill is straight, an inch and a half long, black in color. The female cannot readily be distinguished from its mate.

SOLITARY TATTLER (*Totanus solitarius*).—This bird is also called the WOOD TATTLER. It inhabits the western hemisphere generally, is accidental in Europe, and breeds in the Northern United States and northward. It is migratory, and very abundant, wintering beyond the limits of our country. Wilson regarded it as rare in his day, being then new to science. He says: "It is seldom that more than one or two are seen together. It takes short, low flights; runs nimbly among the mossy margins of the mountain springs and brooks and pools, occasionally stopping, looking at you, and perpetually nodding the head. It is quite unsuspicious, allowing one to approach within a short distance. They breed regularly in Pennsylvania. It is usually silent, unless suddenly flushed, when it utters a sharp whistle. It resembles, in markings as well as manners, the Green Sandpiper of Europe, but differs in being one-third less." The Solitary Sandpiper is eight inches and a half long, and fifteen inches in extent of wing; the bill is one inch and a quarter in length, of a dusky color. The sexes are alike in color. The eggs are of the ordinary pyriform shape. The ground color is clay, without shade. The markings are heavy and numerous on the larger half, smaller and fewer elsewhere, being quite dark-brown, lacking entirely the rich umber shading of those of other members of the family. Dr. Coues regards this bird as not strictly solitary, though perhaps it may be considered as "pretty exclusive in their own set," going in flocks of small numbers, and keeping out of others' company. The Doctor enlarges pleasantly concerning the "*tip-up*" process which these birds indulge in. He says: "It is amusing to see an old male, in the breeding season, busy with this operation. Upon some rock, jutting out of water, he stands, swelling with amorous pride and self-sufficiency, puffing out his plumage until he looks twice as big as natural, facing about on his narrow pedestal, and bowing with his hinder parts to all points of the compass."

SPOTTED SANDPIPER (*Tringoides macularius*).—This bird inhabits North America generally, breeding nearly in every portion. It winters in the Southern States and beyond, being found even in Brazil, and occasionally in Europe. It has a remarkable habit of perpetually wagging the tail, whether running or standing, and is accordingly called, in various sections, Sandlark, Teeter-tail, Peet-weet, Tip-up, etc. It has a weak, plaintive note. The female exhibits great alarm when approached at the time of breeding, and shows great ingenuity in counterfeiting lameness, to draw off the attention from her charge. Wilson records an interesting example of the parental care of this bird, which he had from his friend, Mr. Bartram, the Southern naturalist, who witnessed an attempt of a ground squirrel to seize upon the young. The bird successfully warded off the enemy by a show of bristled front, the young keeping always at the rear. The flight of this bird is low. It skims along the surface of the water, its long wings making a considerable angle with the body, uttering as it goes, *Weet! weet! weet!* The length is seven inches and a half; extent of wing, thirteen inches; bill, an inch long, and straight.

THE RUFF (*Philomachus pugnax*).—This is strictly an Old World bird, but has occasionally been captured in New England, and on Long Island. The singular arrangement of the feathers around the head, which gives rise to the trivial name of this bird, is said to be only temporary, lasting through the breeding season. In May the caruncles of the head become enlarged and red, and the *ruff* begins to appear. By the end of June the latter disappears. The Ruff has a singular habit of gathering in numbers to do battle for the choice of mates. The females also congregate in breeding. This bird is regarded as most delicate game, and in England is much in request. It is about twelve inches in length.

UPLAND PLOVER (*Actiturus bartramius*).—Called also the BARTRAMIAN SANDPIPER, or TATTLER. It is a general inhabitant of North America, though not seen west of the Rocky Mountains. On the Atlantic Coast it is common, breeding in the middle portions and northward. It winters in Mexico and the West Indies, Central and South America. Casually it is seen in Europe; and it is even included in the list of *Birds of Australia*, by Gould. It is exceedingly abundant on the plains between the Rocky Mountains and the Mississippi River, where it is called the Prairie Pigeon. It occurs in immense flocks, thousands together. Dr. Coues says of their note: "It is a long-drawn, soft, mellow whistle, of a peculiarly clear, resonant

quality; but, besides this, they have a note peculiar, I believe, to this period of their lives (that is, when pairing). It is a very loud, prolonged cry, sounding more like the whistling of the wind than a bird's cry. The wild sound, which is strangely mournful, is generally uttered when the bird, just alighted, holds his wings for a moment perpendicularly, before adjusting them over his back. It is frequently heard in the night, all through the breeding season, and is, I think, one of the most remarkable outcries I ever heard. There is yet another note this Tattler utters, chiefly when disturbed in breeding. This is a harsh scream, frequently and quickly repeated, much like that given by other waders." Wilson named this bird as new to science, and describes it from a specimen taken near Mr. Bartram's Botanic Gardens, on the banks of the Schuylkill River. It is twelve inches in length, and twenty-one in alar extent. The bill is an inch and a half long, slightly bent downwards, and wrinkled at the base. The sexes are nearly alike.

BUFF-BREASTED SANDPIPER (*Tryngites rufescens*).—This species ranges over the whole of North America. It is migratory in the United States, and is not common on the eastern sea-coast, though a few are seen every season on Long Island. It breeds far in the north. In winter it is met with in South America. Its habits are said to be most like those of the last-described species. The egg is very pointedly pyriform, of a clay color in ground, with very bold and sharp marking of rich umber-brown.

WANDERING TATTLER (*Heteroscelus incanus*).—A common bird on the Pacific Coast of North and South America and Japan. It is distinguished by its uniformly plain colors.

LONG-BILLED CURLEW (*Numenius longirostris*).—This bird is familiar to all parts of the United States, and breeds in most sections, wintering in Mexico and south to Brazil. The Long-billed Curlew was formerly considered a mere variety of the English species, but it is now regarded as distinct. Wilson says the Curlews appear in the salt marshes of New Jersey about the middle of May, on their way to the north, and in September, on their return to their breeding-places. Their food consists chiefly of small crabs, which they are very dexterous at probing for and pulling out of holes with their long bills. They likewise feed on bramble-berries, frequenting the fields and uplands for that purpose. Dr. Newberry found the Long-bill very abundant in the valley of the Sacramento, California.

HUDSONIAN CURLEW (*Numenius hudsonicus*).—This bird is common to North America, Central and South America. It breeds in high latitudes, is migratory in the United States, and winters in the South and beyond. It is much less known than the others. is rare in New England, but not uncommon on the coast of New Jersey, its western range being as far as Kansas. The habits of this bird are little known. Wilson mentions it under the name of Esquimaux Curlew (*Scolopax borealis*). The habits are said to be the same as the latter. The egg is larger; otherwise it cannot be distinguished.

ESQUIMAUX CURLEW (*Numenius borealis*).—Inhabits North and Middle America, but is not found west of the Rocky Mountains. It breeds within the arctic circle, is migratory within the United States, but rarely seen in winter. It is said to be extremely abundant in Labrador, in August, wintering in Central America and South America. It is not known in the West Indies. Dr. Cones says: "Their note is an oft-repeated, soft, mellow, though clear whistle, which may be easily imitated. When in large flocks, they have a note which, when uttered by the whole number, I can compare to nothing but the chattering of a flock of Blackbirds." Their food consists almost entirely of the crowberry (*Empetrum*). They also, like others of the tribe, feed on small terrestrial mollusca. It breeds abundantly in the Anderson River, region; has four eggs, usually in June, in a nest made on the open plain—a mere depression in the ground—lined with a few dried leaves or grasses. This Curlew is eighteen inches in length and thirty-two in alar extent; its bill is four and a half inches in length, black towards the point, and a pale purplish flesh color near the base.

FAMILY—TANTALIDÆ.

THE IBIS.

WOOD IBIS (*Tantalus loculator*).—This bird is an inhabitant of the warmer portions of our continent—the South Atlantic and Gulf States, and across to the Colorado River. It occasionally reaches Pennsylvania, and not unfrequently is seen in Ohio and the Carolinas. In Cuba, Mexico and South America it is at home. The Wood Ibis is Crane-like in aspect, being four feet in length. It is a pure white in color, with black tips to wings and tail. The head is entirely bald in the adult bird, and the bill is extremely thick and heavy. Like many other birds, it is absurdly named in certain regions, being called Gannet in Florida and Water Turkey in Colorado. Dr. Cones, in a pleasant description of the Wood Ibis at Fort Yuma, says: "They leave their retreat about noon, flapping heavily until they clear all obstacles, then mounting faster, with strong, regular beats of their broad wings; now they sail in circles, with wide-spread, motionless pinions, supported as if by magic. A score or more cross each others paths in interminable spirals, their snowy bodies, tipped at the wings' point with jetty black, clear-cut against the sky; they become specks in the air, and finally pass from view. The carriage of the Wood Ibis is stately and firm. Each leg is lifted slowly and planted with deliberate precision before the other is moved, when the birds walk unsuspicious of danger. It springs powerfully from the ground, bending low to gather strength, and for a little distance flaps hurriedly with dangling legs, as if it was much exertion to lift so heavy a body." Bartram says that "they are never seen on the sea-coast, but yet are never far distant from it. They feed on serpents and other small reptiles." The length is about four feet; bill is nearly nine inches. The young differ in color from the adult.

GLOSSY IBIS (*Ibis falcinellus*).—This species has about the same range as the preceding, being common in the South Atlantic and Gulf States, and occasionally straggling as far north as Massachusetts. Audubon found it in flocks in Texas. Bonaparte first described it as an United States bird—as I. ordii—from the fact that Mr. Ord first captured it in New Jersey. The egg is rougher and more granular than those of the Herons.

FAMILY—ARDEIDÆ.

GREAT BLUE HERON (*Ardea herodias*).—This is a very familiar bird in the Eastern States, and is common to the whole continent, south to Guatemala and the West Indies. It breeds in all these regions, and winters in the south. It is only equalled, in its wide distribution throughout the continent, by the Bittern. The Great Blue Heron is one of the most beautiful and striking members of the feathered race known to our land, its graceful form tall and commanding, crowned with delicate plumes, and bearing in other parts the richest forms of light and airy plumage. They breed in Carolina, near the sea; and in New Jersey, according to Wilson, they "build in the gloomy solitudes of the tallest cedar swamps, where, if unmolested, they continue to breed for many years successively."

FLORIDA HERON (*Ardea wurdemanni*).—This is a new species, discovered by Mr. Wurdemann, in Southern Florida.

GREAT WHITE HERON (*A. occidentalis*).—This is a fine, large bird, pure white in plumage, and measuring over three feet in length. It is confined to the warmer portions of America, but has been seen as far north as New York. It is nearly allied to the A. alba of Europe.

GREAT WHITE EGRET (*Ardea egretta*) — Plate 24, fig. 93.—Called also the WHITE HERON. Is a southern species, although found at times as far north as Nova Scotia, and west to Minnesota. It winters in the West Indies and Central America. This is a very strikingly beautiful bird, always readily known by its pure white plumage, yellow bill and black legs. It is about three feet in length, distinguished from the Little White Egret by its greater size. This Egret, Wilson says, breeds in the great cedar swamps of Southern New Jersey. Their nests are built on trees, in societies, the eggs being usually four, of a pale blue color. We have seen great numbers of these birds standing on the flats near Cedar Keys, in Florida, when they have very much the appearance, at a distance, of a long white picket fence. In the everglades and in the mangrove thickets of the backwaters of the Florida Reef, they are particularly abundant. When seen standing listlessly in the shoal-water beneath the dense foliage of the mangroves, they afford a beautiful picture.

LITTLE WHITE EGRET (*Ardea candidissima*).——Called also the SNOWY HERON. This is confined mostly to the Southern United States, although it is sometimes seen as far north as Massachusetts. It ranges through Mexico, the Antilles, and south to Peru. It breeds throughout its range. This bird so resembles the European species—the Little Egret—that it was frequently considered the same. It has, however, a larger crest, yellow feet and curled plumes on the back—all different from the European—and is also very much larger. It is partial to salt marshes, and seldom goes far inland—like, in this respect, the others of this tribe. The length of this species is two feet one inch; extent of wing, three feet two inches; the bill is four inches and a quarter long. The female is quite like the male; the ornaments of plumage not quite so long and flowing. They breed, like others, in trees, and in societies.

LOUISIANA EGRET (*A. leucogastra*).—Described by Wilson and Audubon as A. ludoviciana. Dr. Coues records it as a variety leucoprymna. It is native to the tropical portions of America, but occasionally reaches as high as the Carolinas.

REDDISH EGRET (*A. rufa*). — This is another strictly tropical species, found in Florida and the Gulf States. It has been variously named—Demi-egretta rufa, by Baird; Ardea rufescens, by Audubon; A. pealei, by Bonaparte and others.

LITTLE BLUE HERON (*A. cærulea*). — Though a southern species, this bird is sometimes seen as far north as New England, in summer. It is abundant in the Gulf States.

GREEN HERON (*Ardea virescens*). — Called also POKE. Lives in the United States generally, breeding throughout, and wintering in the south. It ranges through Mexico, the Antilles, to South America. Wilson says of it: "It fares best where civilization is least known or attended to, its favorite residence being the watery solitudes of swamps, pools and morasses, where millions of frogs and lizards tune their nocturnal notes in full chorus, undisturbed by the lords of creation. When on the lookout for fish, he stands motionless in the water, his neck drawn in over his breast, ready for action. The instant a fry or minnow comes within range of his bill, by a stroke quick and sure as that of the rattlesnake, he seizes his prey, and swallows it in an instant." When alarmed, this Heron rises with a hollow, guttural scream; does not fly far, but usually alights on some old stump, and looks about with extended neck. As it walks along, it has the habit of jetting the tail. It is found in the interior, in every marsh or pond-hole. The nest is fixed among the branches of the trees, is constructed wholly of small sticks, lined with finer twigs, and is of considerable size, though loosely put together. It is eighteen inches long; alar extent twenty-five inches. The bill is black, lighter below and yellow at base.

AMERICAN NIGHT HERON (*Nyctiardea grisea*).—This beautiful bird is common in all parts of the United States and the British Provinces, breeding in great abundance in New England, and wintering in the south. It is seen in a portion of the West Indies, Mexico, Central and South America. In some sections it is called Qua-bird and Quock, from its peculiar cry, which it utters when flying. We have heard this bird uttering its peculiar cry in the even-

ing, while it was flying towards Nahant from a breeding-place in the forests of Lynn. It was probably on its way to fish for an evening meal. Wilson describes them as arriving in Pennsylvania early in April, and immediately taking possession of their former breeding-place, which is usually the most solitary and deeply-shaded of a cedar-swamp. Groves of swamp-oak, in retired and inundated places, are also sometimes chosen; and the males not unfrequently select tall woods on the banks of the river to roost in during the day. These last regularly direct their course, about the beginning of evening twilight, towards the marshes, uttering in a hoarse and hollow tone the sound *qua!* which by some has been compared to the retching of a person attempting to vomit. At this hour all the nurseries in the swamp are emptied of their inhabitants, who disperse about the marshes and along the ditches and river-shore, in quest of food. Some of these breeding-places have been occupied every spring and summer from time immemorial, by from eighty to an hundred pairs. In places where the poles have been cut down, the birds have merely moved to an adjoining quarter. When much pushed and annoyed, they are known to move in a body to some unknown locality. The nests are built entirely of sticks, sometimes several in one tree. On entering a swamp occupied by one of these breeding places, the noise of old and young would almost induce one to suppose that two or three hundred Indians were choking or throttling each other. The instant an intruder is discovered, the whole rise in the air in silence, and remove to the tops of the trees, in another part of the woods, while parties of from eight to ten make occasional circuits over head, to see what is going on. When the young are able, they climb to the highest parts of the trees. Though it is probable that they do not see well by day, yet their hearing is exquisite. Curiously enough, the sexes are alike in plumage, both having the beautiful plumes and rich coloration. The length of the Night Heron is two feet four inches, and four feet in extent of wing; the bill is black, and four inches and a quarter long; the eye is large, the iris of a deep blood-red. The food of the Night Heron is small fish chiefly, which it takes at night.

YELLOW-CROWNED NIGHT HERON (*N. violaceus*).—A southern species, quite common in the Gulf States, but seldom seen above Pennsylvania. It is about the size of the preceding.

AMERICAN BITTERN (*Botaurus minor*).—This bird may be found in all parts of temperate North America, and south as far as Guatemala. Though not numerous, it is yet common to all our sea and river marshes, where it feeds only during the night. It is called in some regions the Indian Hen. On the sea-coast of New Jersey it is called the Dunkadoo—a word probably derived from its note or call. It has none of the booming sound which characterizes the English species, but utters at times a low guttural note while in the midst of the reeds. This circumstance, with the difference of marking, sufficiently prove that they are distinct, although hitherto the European has been considered a mere variety of this. "These birds," says Wilson, "we are informed, visit the Severn, at Hudson's Bay, about the beginning of June, make their nest in swamps, laying four curious green eggs among the long grass. The young are said to be at first black. These birds, when disturbed, rise with a hollow *kwa!* and are then easily shot down, as they fly heavily. Like other night birds, their sight is most acute during the evening twilight; but their hearing is, at all times, exquisite." The American Bittern is twenty-seven inches long, and three feet four inches in ular extent; the bill is four inches long, the upper mandible black, the lower greenish-yellow. Mr. Samuels says of this bird: "It breeds in communities, sometimes as many as a dozen pairs meeting within an area of a few rods. The nests are placed on low bushes or on tufts of grass, sometimes in low, thickly-wooded trees, and are composed of coarse grasses, twigs, and a few leaves. I know of no other place in New England where these birds breed in such abundance as in the neighborhood of Richardson's Lakes, in Maine. There, in some of the tangled, boggy, almost impenetrable swamps, these birds have several heronies, which they have inhabited for years. The Bittern, as has been said, is essentially wild, shy and solitary. One is oftener started from the bog than several, or even a pair. He stands motionless, with his head upon his shoulders, and half-closed eyes, in profound meditation, or steps about in devious ways, with an absent-minded air. For greater seclusion, he will often hide in a thick bush-clump for hours. Startled in his retreat, while his thinking-cap is on, he seems dazed, like one suddenly aroused from a deep sleep; but as soon as he collects his wits—remembering unpleasantly that the outside world exists—he shows common sense enough to beat a hasty retreat from a scene of altogether too much action for him. Some such traits have led to the belief that he is a nocturnal bird, but such is not the case. He may migrate by night, but so does the Killdeer and the Bobolink, and many other birds not in the least nocturnal. Nor is he lazy or stupid, as is supposed. He is simply what we may call a shady character—one of those non-committal characters which we may invest, if we please, with various attributes, and perhaps consider very deep, without sufficient reason; the fact being that we make the mystery about him. He lives in the bog, where he finds plenty to eat, and simply wishes to be let alone. When the Bittern is disturbed in his meditations, he gives a vigorous spring, croaks at the moment in a manner highly expressive of his disgust, and flies off as far as he can, though in rather a loose, lumbering way. For some distance he flaps heavily, with dangling legs and outstretched neck; but when settled on his course, he proceeds more smoothly, with regular, measured wing-beats, the head drawn in closely and the legs stretched out behind together like a rudder."

LEAST BITTERN (*Ardetta exilis*).—This bird is found in the United States and British Provinces, breeding throughout the country, and wintering in the south. It is found in Cuba, Jamaica and in Central America, and though generally distributed, it is no-

where abundant. Coues says that he found it in reedy swamps—just such places as the Rails frequent—where, when startled, it flies up in a manner reminding one of a Rail. Like the Bittern, it is regularly migratory, passing northward in April, and southward in September. It is said to reside in the Gulf States, and to be more numerous there than elsewhere. It does not appear to gather in communities to breed, like most of the Herons, but is oftenest found singly or in pairs, or, at most, three or four pairs. It is also an exception among Herons, that the sexes are alike in color. It bears a curious likeness or analogy to the Rails, in several respects. The nest, according to Audubon, is sometimes placed on the ground, amid the rankest grasses, but more frequently it is attached to stems several inches above it. It is flat, composed of rotten weeds, and in shape resembles that of the Louisiana Heron, though this latter employs nothing but sticks. In two instances was found the nest of the Least Bittern about three feet from the ground, in a thick cluster of smilax and other briery plants. In the first, two nests were placed in the same bush, within a few yards of each other. In the other instance, there was only one nest of this bird, but several of the Boat-tailed Grackle and one of the Green Heron, the occupants of all of which seem to be on friendly terms. When startled from the nest, the old birds emit a few notes, resembling the syllable *qua*, alight a few yards off, and watch all your movements. If you go towards them, you may sometimes take the female with the hand, but rarely the male, who generally flies off, or makes his way through the woods. The food consists of snails, slugs and reptiles. In several instances, small mice and shrews are found in their stomachs.

FAMILY—GRUIDÆ.

THE CRANES.

WHOOPING CRANE (*Grus americanus*)—called also the WHITE CRANE—is found in the interior of North America, up the Mississippi River and through the fir countries; Texas to Florida, and occasionally up the middle coast. This species has a windpipe between four and five feet long—quite as long as the bird itself. The distribution of this Crane seems to be somewhat peculiar, as may be gathered from Dr. Coues' remarks, in his *Birds of the Northwest:* "It is said to be found throughout the fir countries, but its distribution in the United States is somewhat limited, and there is difficulty in determining from accounts, since authors have confounded it with the Sand-hill Crane. I find no satisfactory evidence of its occurrence in New England, and Mr. Lawrence omits it in his New York list. It is thought to have bred in Wilson's time at Cape May, New Jersey, and is said to be common in Florida. I have never seen it alive except in Northern Dakota, where I observed it in August and to October, and where it probably breeds. Its principal line of migration appears to be the Mississippi Valley at large. Accounts of its presence all along this belt, from Texas to Minnesota, for a considerable breath, are unanimous and conclusive. Here it seems to be chiefly migratory, but there is every reason to believe that it breeds in Minnesota, and, as just said, in Dakota, as it also does further north. * * * This tall and stately white bird, of the most imposing appearance of any in this country, I have only seen on the broad prairie, or soaring on motionless pinions high over head. Its immense stature is sometimes singularly exaggerated by that quality of the prairie air, which magnifies distant objects on the horizon—transforming sometimes a weed into a man, and a Wild Turkey into a Buffalo. The most fabulous accounts of a Crane's size might readily arise without intentional deception. I have known a person to mistake a Sand-hill Crane for one of his stray mules, and go in search of him."

SAND-HILL CRANE (*Grus canadensis*)—called also the BROWN CRANE—is found in the United States generally, from Florida and the Mississippi Valley to the Pacific; breeding in the same, and wintering in Cuba. These birds rise heavily and slowly from the ground, on being disturbed, and fly in circles, until they reach the desired elevation. When proceeding from one favorite resort to another, or when migrating, the flight is high, and not unfrequently their approach is heralded, before they are in sight, by their incessant whooping clamor. While feeding they are generally silent. Dr. Cooper says that the Brown Cranes are common summer residents in Washington Territory, arriving at the Straits of Fuca in large flocks in April, and then dispersing in pairs over the prairies to build their nests, which are placed on the tall fern on the highest and most open ground, where they can see the approach of danger. They frequent, at this season, the mountains, at the height of 6,000 feet above the sea. The young are often raised from the nest by the Indians for food. "In the autumn," Dr. Newberry observes, "it is abundant on the prairies of California, and is always for sale in the markets of San Francisco, where it is highly esteemed as an article of food. In August we frequently saw them about the Klamuth Lakes; and early in September, while in the Cascade Mountains, in Oregon, the Cranes were a constant feature of the scenery of the beautiful but lonely mountain meadows in which we encamped. We found them always exceedingly shy and difficult to approach, but not unfrequently the files of their tall forms, stretching above the prairie grass, or their discordant, sounding screams, suggested the presence of the human habitations of the region, whose territory was now for the first time invaded by the white man. The Cranes nest in these Alpine meadows, and retreat to the milder climate of the valleys of California when winter approaches. In Oregon they begin to move southward in October." "Thousands of Sand Hill Cranes repair each year to the Colorado River Valley, flock succeeding flock along the course of the great streams, from their arrival in September to their departure the following spring. Taller than the Wood Ibis and the largest Herons with which

they are associated, the stately birds stand in the foreground of the scenery of the valley, the water now reflecting the shadow of their broad wings, then the blue sky exhibiting the outline of their commanding forms. Such ponderous bodies, moving with slowly-beating wings, give a great idea of momentum from mere weight—of force of motion without swiftness, for they plod along heavily, seeming to need every inch of their ample wings to sustain themselves. One would think they must soon alight, fatigued with such exertion, but the raucous cries continue, and the birds fly on for miles along the tortuous stream, in Indian file, under some trusty leader, who croaks his hoarse orders, implicitly obeyed. Each bird keeps his place in the ranks, the advancing column now rising higher over some suspected spot, now falls along an open sandy reach, swaying meanwhile to the right or left. As it passes on, the individual birds are blended in the hazy distance, till, just before lost to view, the line becomes like an immense serpent, gliding mysteriously through the air. When about to alight, fearful lest the shadows of the wood harbor unseen danger, the Cranes pass by the leafy intricacies, where the Ibises and other less suspicious birds feed, and choose a spot for the advantage it may possess of uninterrupted vision. By nature one of the most wary and discreet of birds, his experience has taught him to value this gift, and put it to the best use. His vigilance is rarely relaxed, even when he is feeding, when less thoughtful birds would feel perfectly secure. After almost every bending of his long neck to the ground he rises again, and at full length glances keenly on every side. He may resume his repast, but should so much as a speck he cannot account for appear, he stands motionless, all attention. Now let the least sound or movement betray an unwelcome visitor, he bends his muscular thighs, spreads his ample wings, and springs heavily into the air, croaking dismally to warn all his kind within reach of his far-sounding voice."—*Coues*. The eggs are of the same general character as those of the G. americana.

FAMILY—ARAMIDÆ.

This family consists of a single genus, and probably with only one species. It is only represented in the tropical portions of the continent.

THE CRYING BIRD; COURLAN (*Aramus giganteus*)—Plate IX, fig. xxi.—This is rather a peculiar bird, its appearance and habits being somewhat different from any other, although closely allied to the Rails in the essential points of structure. It bears the name also of Scolopaceous Courlan, and is numerous in South America and Cuba. In the United States it is quite confined to the Coast of Florida. A few instances have occurred of its visiting the Middle States. It leads a solitary life, only associating in pairs, having a piercing cry of *Carau! carau!* which is heard both by night and day. We have seen this bird killed at Indian Key, Florida Reef, while alighting upon the Cocoanut trees. At this time two women issued forth from their domestic duties, each with a "fowling-piece" in hand. One of them brought the pair of birds to the ground, and deliberately twisted off their necks, and proceeded to prepare them for dinner, as they are much esteemed as game.

FAMILY—RALLIDÆ.

THE RAILS

Members of this family inhabit all temperate countries. The most remarkable characteristic is their extreme narrowness, or compression of the body. They are not distinguished for great development of wing, yet they make extensive migrations, walk with great ease, and some species swim well. Their cries are "loud, dry and harsh."

MARSH HEN (*Rallus elegans*).—Called also KING-RAIL and FRESH-WATER MARSH-HEN.—This large and beautiful bird is found in the United States, being more common in the southern portions. It frequents fresh-water marshes and ponds in the interior, as well as along the coast, feeding on seeds, insects, tadpoles, etc. What little has been placed on record about this bird, respecting its habits, does not indicate anything peculiar.

VIRGINIA RAIL (*R. virginianus*) is found in the entire United States and the British dominions. It breeds commonly in New England, and winters in the Southern States, and as far south as Guatemala. Dr. Coues thus describes it: "A night at Soda Lake, the debouchure of that singular river, the Mohave, was one of the strangest and one of the most uncomfortable I ever passed. It was late in October, and the full moon threw a pale and uncertain light over a scene of desolation and death. On one side stretches the interminable desert of shifting sand, broken here and there by clumps of the foul creosote plant, straggling patches of grease-wood and bitter sage, and scattered, sentinel-like Spanish bayonet. Along the road just traversed were strewn bleached skeletons of beasts that had fallen in the tracks beneath the scorching rays of the sun. At the foot of some cliffs near by lay whitening the heads and horns of the Argali (*Ovis montani*), shot by previous travellers. The bare bones looked of double size and fantastic shape in the pale moonlight. Before us lay a dead white sea of salty efflorescence, where the lake had evaporated or sunk in the sand, leaving its saline matter. It was dry except towards the middle, where dark-green masses of Tulé-reeds, contrasting with snowy whiteness all around, showed that little water was left. Our animals, like ourselves, were exhausted. One poor creature, cruelly overtasked, had given birth to a foal, and lay groaning by the wayside, unable to rise. The water was too nauseous to drink, and hardly answered to cook with. But even under such circumstances, I was gratified by the presence of feathered friends. At nightfall some Mallard and Teal settled into the rushes, gabbling curious vespers as they went to rest. A few Marsh-wrens had appeared on the edge of the reeds, queerly balancing themselves on the thread-like leaves, see-sawing to their own quaint music. Then they were

hushed, and, as darkness settled down, the dull, heavy croaking of the frogs played bass to the shrill falsetto of the insects. Suddenly they, too, were hushed in turn, frightened, maybe, into silence; and from the heart of the bulrushes *Crick-rick-k-k-k!* lustily shouted some wide-awake Rail, to be answered by another and another, till the reeds resounded."

CLAPPER RAIL (*R. longirostris*). — This familiar Rail inhabits the whole of the Atlantic Coast, from New England to Florida. Local names are numerous and confusing. It is known as Salt-water Marsh-hen, Mud-hen, etc. It is the R. crepitans of Wilson, who adds the trivial names, Meadow Clapper and Big Rail. It migrates regularly, arriving on the coast of New Jersey about the last of April.

CAROLINA RAIL (*Porzana carolina*).—Called in the Middle States SORA, and named ORTOLAN in some quarters. It is common to the entire temperate regions of North America, breeding from the Middle States northward, and wintering in the Southern States and beyond. It is found south as far as Venezuela, and in the West India Islands and north as far as Greenland. Dr. Coues regards it as not common in the Western States. Mr. Allen found it in Utah, about Great Salt Lake, and Dr. Coues in Arizona. The eggs are like the other species, but are distinguished by their strong drab color, are rather smaller, and perhaps more obtuse. Wilson describes this species as Rail, and remarks: "Of all our land or water-fowl, perhaps none afford the sportsman more agreeable amusement or a more delicious repast than the little bird now before us. This amusement is indeed temporary—lasting only two or three hours in the day, for four or five weeks in each year—but, as it occurs in the most agreeable and temperate of our seasons, is attended with little or no fatigue to the gunner, and is frequently successful. It attracts numerous followers, and is pursued in such places as the bird frequents, with great eagerness and enthusiasm. Early in August, when the reeds along the shores of Delaware have attained their full growth, the Rail resorts to them in great numbers, to feed on the seeds of this plant. When the reeds are in seed, or even when in blossom, the birds take possession in great numbers. As you walk along the embankment, they may be heard squeaking like so many puppies. If a stone be thrown among them, there is a general outcry, and a reiterated *Kuk-kuk-kuk!* something like that of a guinea-fowl." Wilson distinctly asserts, in this connection, that he has frequently discovered them clinging with their feet to the reeds under water, and at other times skulking under the floating reeds, with their bill just above the surface." Sometimes they dive when wounded, and keep under the gunwale of the boat, moving as the boat moves, and escaping when opportunity offers. We hear of certain water-fowl diving at the flash of the gun, and gunners assert that they remain under water, attached by the bill to some submarine plant. If Wilson's observation be correct, we may receive the latter as truth. In Virginia, about the James River, they are taken, in dark nights, by negroes. A boat is rigged with a low mast, and a fire-grate to light up the reeds. The negroes then push the boat through the swamp, and knock the birds down with a paddle—in this way securing great numbers. This Rail is frequently met with at sea, specimens having dropped upon the deck of vessels, showing plainly that they migrate to other shores. Wilson details some interesting items concerning the curious habits of the Rail, in "falling into a passion or fit." We have known other species to be frightened into an epileptoid condition, and so captured easily. This Rail is nine inches in length and fourteen inches in extent of wing.

LITTLE YELLOW RAIL (*P. noveboracensis*).—The habitat of this Rail is Eastern North America, ranging north to Hudson's Bay. In New England it is not observed beyond Massachusetts. It is not an abundant species.

LITTLE BLACK RAIL (*P. jamaicensis*).—This little species is an inhabitant of southern clime, though it has been captured as far north as New Jersey, and once, by Mr. Allen, in Kansas. It reaches as far as Chili, in South America; is common in Central America and the West Indies, but seems to be rare in all parts of the United States. Two specimens were captured during a sojourn of eight years, by the writer, at Tortugas, Fla. These were taken inside Fort Jefferson, in the coarse grass, where they strove to hide; but the vigorous shouting of a couple of boys threw them into the peculiar condition mentioned by Wilson, as seen in the Sora, and they were easily taken.

FLORIDA GALLINULE (*Gallinula galeata*).—Birds of this group will be immediately recognized by the presence of a broad, horny plate (an expansion of the bill) which covers the forehead. In the structure of the feet the Gallinules are much like ordinary Rails, having little or no marginal fringe on the toes; but the Coots are conspicuously lobe-footed, the toes being furnished with a series of broad, semicircular flaps.

FLORIDA GALLINULE (*Gallinula galeata*).—This bird is mostly a southern one, found rarely as far north as Massachusetts; occasionally as far west as Kansas, and south as far as Chili. It is known to breed in Massachusetts, and even as far north as Hamilton, Ontario, it is recorded as "common." It winters in the South Atlantic and Gulf States.

AMERICAN COOT (*Fulica americana*). — This is also called the MUD-HEN. Its habitat is the entire temperate North America, west to Alaska. It breeds in nearly all this range. The nests of this bird are built on reedy banks, and sometimes in the midst of wet clumps, so that they are sometimes quite submerged. "The Coot," says Bartram, "is a native of North America, from Pennsylvania to Florida. They inhabit large rivers, fresh-water inlets and bays, lagoons, etc., where they swim and feed in the midst of the grasses and reeds of the shores, particularly in the St. John's River, in East Florida, where they are found in immense flocks. They are loquacious and noisy, talking to one another night and day, and are constantly on the water, the broad lobated membranes on their toes enabling them to swim with ease and to dive like ducks."

It visits Sweden and Norway, on the coast, rarely reaching the moors or lakes. It is found in Northern Asia, and is common in France. In Great Britain it is found at all seasons, and is regarded as not migrating. Dr. Coues met it in Southern California and Dakota, where it was associated with Ducks, Geese, Herons, etc. "Though as shy as Ducks, they have not the wariness of those birds, to teach them to fly from danger, but perhaps the nature of the resorts which they trust for concealment serves for their protection. I do not recollect when, if ever, I have seen Coots fly up into the air, and away. If they are surprised too far from their retreats to regain them in an instant, they splutter along just over the water, half flying—a habit which has gained for them, in some districts, the name of Shufflers or Flusterers. They are generally, however, called Mud-hens—a name shared by some Grebes, as well as *Poules d'eau*, White-bills and other local designations. As an article of food, they may take fair rank, though they are to be considered, on the whole, as inferior to most Ducks." The Coot is much less understood than almost any other bird in our list of North America. It is unfortunately one that has local names in many portions of the country, so that, if it is a bird in one section, it may be a reptile in another and a small mammal in a third. The lobe-foot should distinguish it at once; but its habits are so peculiar, it is seldom seen except by the hunter who penetrates the deepest recesses of the swamps.

Family—PHŒNICOPTERIDÆ.

The Flamingoes.

This is a small and very peculiar group, embracing about six species, in various parts of the world, in warm latitudes. The organization corresponds essentially with the Ducks.

AMERICAN FLAMINGO (*Phœnicopterus ruber*)—Plate 29, fig. 109.—This is a most elegant bird in plumage, as well as unique in its shape. It is nearly confined to the shores of Florida, though individuals have been seen farther north. The nest is said to be constructed as a tall, funnel-shaped object, upon which the bird sits astride while incubating.

Family—ANATIDÆ.

Swans, Geese and Ducks.

TRUMPETER SWAN (*Cygnus buccinator*).—This elegant bird is an inhabitant of the Mississippi River, and northward to the Pacific, Hudson's Bay and Canada. Rarely it is seen on the Atlantic Coast. In winter it ranges to the Gulf. Dr. Coues says: "I have observed the Trumpeter on but few occasions, in Dakota only, late in September and the first half of October, when the birds were migrating southwards, with great numbers of Canada and Snow Geese, and various Wild Ducks. Their loud and strange, almost startling notes, were oftenest heard throughout the night, as they passed over head, but I also saw some Swans flying in the daytime near Fort Stephenson, on the Upper Missouri." According to Dr. Hayden, the birds breed in the Yellowstone region, as they also do, according to other writers, in Minnesota and Iowa. We have other accounts of their breeding in Alaska; and Dr. Richardson, who gives it as the commonest species in the interior of the fur countries, states that it nests principally within the Arctic Circle. In the fall the birds proceed along the whole course of the Mississippi. Audubon states they made their appearance on the lower waters of the Ohio about the end of October, and that they are frequently exposed for sale in the New Orleans market, being procured on the ponds in the interior and on the great lakes leading to the Gulf. They are occasionally seen on Lake Erie, as well as on the Chesapeake and Delaware. Dr. Newberry considers them rare in California.

AMERICAN, OR WHISTLING SWAN (*Cygnus americanus*).—The habitat of this bird is considered to be pretty general over the continent of North America, breeding in the far north. In the Gulf States it is not known, but is common on the Pacific border. A favorite resort is Chesapeake Bay, where, in November, it is comparatively abundant. The Philadelphia and Washington markets are supplied from there.

WHITE-FRONTED GOOSE (*Anser albifrons*) is common to the continent of North America, breeding in the far north and wintering in the United States and in Cuba. In California it is called Speckled-belly, where it is very abundant. It associates with the Snow and Hutchins' Goose, and appears to have the same general habits, subsisting upon the same kind of food. The Californians have a method of hunting this Goose which is quite novel. They teach a bullock to feed quietly along up to the flock, and then follow it until within range.

SNOW GOOSE (*Anser hyperboreus*).—Inhabits the whole of North America; breeds in high latitudes; winters in the United States; is abundant in the interior and along the Pacific Coast, and rare on the Atlantic. It is seen occasionally in Europe. Wilson says of it: "This species, called on the Delaware the Red Goose, arrives in November, sometimes in considerable flocks, and is extremely noisy, their notes being shriller and more squeaking than those of the Canada or Common Wild Goose. From the middle of February to the breaking up of the ice in March, they are quite numerous. They feed on the roots of the reeds, and, like most of their tribe, the flesh is excellent eating." The Snow Goose is two feet eight inches in length, and five feet in extent of wing; the bill is three inches in length, remarkably thick at base, and rising high in the forehead, but becomes small and compressed at the extremity, where each mandible is furnished with a whitish, rounding nail. Dr. Heerman says: "They often cover the plains so densely as to give the ground the appearance of being clothed with snow. So abundant are they, that the natives have often been seen to kill dozens of them by riding swiftly into a flock as it rested on the plains." An interesting case is related by Mr. Ridgway, of a Snow Goose taking up its quarters with a tame flock, and living with them nearly a year. The term *laughing* or *grin-*

ning was bestowed on this species on account of a peculiar conformation of the bill. Two rows of strong teeth are exposed on both sides, which give a singular aspect, resembling grinning. These Geese feed on bulbous aquatic plants and small mollusca. Audubon says they sometimes pluck up the small wheat plants, consuming great quantities.

ROSS'S GOOSE (*Anser rossi*).—"This curious little Chen," says Dr. Coues, "in which a long-lost species is easily recognized, is an inhabitant chiefly of Arctic America, but, like the Snow Goose, is now known to migrate into the United States in winter. It has been taken at San Francisco. With exactly the coloration and form of A. hyperboreus, it is immediately recognized by its small size—being no larger than a Mallard—less exposure of the teeth of the bill, corrugation of the base of the bill, and the nearly straight, instead of strongly convex, outline of the feathers at the sides." Another name for this bird is Horned Wary.

BLUE GOOSE (*Anser cærulescens*).—Inhabits North America generally. Dr. Coues says: "It is a perfectly distinct species from A. hyperboreus, the young of which, however much resembling it, is quite different. The plumage of the adult bears a curious superficial resemblance to Philacti canagica, the distribution of the colors being much the same.

CANADA GOOSE (*Branta canadensis*), or COMMON WILD GOOSE, is found in all parts of North America, where it breeds. It is accidental in Europe. Dr. Coues states that these birds nest in the Yellowstone and Upper Missouri region, in trees, and are also known to build in heavy timber along the larger streams, and to transport the young to the water in their bills. This corresponds to the habits of the Wood Duck. The Hutchins' Goose is a variety of the preceding, and found more plentiful west of the Rocky Mountains.

THE BRANT (*Branta bernicla*) — also called BRANT GOOSE and BLACK BRANT—is common to Europe and North America, but is rarely seen on the Pacific Coast. A variety, called B. nigricans, is rare on the Atlantic side, and replaces the B. bernicla on the Pacific Coast. Dr. Coues says: "While ascending the Missouri in October, 1872, I observed vast numbers of the Brant in flocks on the banks and mud-bars of the river. It is generally disposed over the continent, but chiefly in its eastern portions, where the variety nigricans is rare. Usually the Black Brant is said to come in immense flocks, and to afford more sport than any other wild fowl. Dr. Lucklay states they are extremely abundant at the Straits of Fuca during the winter, preferring the vicinity of the coast, and subsisting by choice on sedge-grass growing near salt water." On the Atlantic Coast, the common variety has been seen as far south as Carolina. The Barnacle Goose was regarded as the same species as the present by Wilson, but is now considered distinct. Wilson says: "The Brant, or Brent, is expected at Egg Harbor, on the coast of New Jersey, about the first of October. The first flocks generally remain a few days, and then pass on to the south. On recommencing their journey they collect in one great body, and, making an extensive spiral course some miles in diameter, rise to a great height in the air, and then steer for the sea, over which they uniformly travel, often making wide circuits to avoid passing over land or a projecting point. In these aërial routes they have been met with many leagues from the shore, travelling the whole night. Their line of march very much resembles that of the Canada Goose, with this exception—that frequently three or four are crowded together in front, as if striving for precedency. Flocks continue to arrive from the north, and many remain in the bay until December, or until the weather becomes severe, when these also move off southwardly. During their stay they feed on the bars at low water; seldom or never in the marshes, their principal food being a remarkably long and broad-leafed marine plant, of a bright green color, which adheres to stones. Their voice is hoarse and *honking*, and, when some hundreds are screaming together, reminds one of a pack of hounds at full cry. They often quarrel among themselves, and with the Ducks, driving the latter off the feeding-grounds. Their breeding-place is supposed to be very far to the north." He adds that the Brant never dives in search for food, but is known to swim under water during a hundred yards at a stretch.

MALLARD (*Anas boschas*)—Plate VIII, fig. xx.—This bird belongs to a sub-family (the River Ducks), and is nearly a world-wide inhabitant, being almost everywhere domesticated. Throughout the whole of North America it is wild, being generally known as the Wild Duck. It is found in all lakes and rivers, but is seldom seen on the sea-coast or salt marshes. Its flesh is considered as only second in quality to that of the Canvas-back Duck. The length of the Mallard is twenty-four inches; extent of wing, thirty-six inches. "This is the original stock of the common domesticated Duck, reclaimed time immemorial from a state of nature, and now become so serviceable to man."—*Wilson.*

BLACK DUCK (*Anas obscura*).—Although familiarly known as the BLACK DUCK, yet it is more properly the DUSKY DUCK, a name which it bears in some locations, as it is not wholly black. This species is abundant along the Atlantic Coast, from Labrador to Texas; is resident in Florida, and noticed in Kansas and Iowa. It breeds plentifully in Maine, where it is one of the most abundant of its kind. During the winter months it is a constant article in market. The food of this Duck is principally the small shell-fish which abound in the salt marshes; its flesh, therefore, is not much esteemed, having a somewhat disagreeable odor. Its voice resembles the Mallard, and, like that bird, it rarely dives, but swims and flies with great strength and velocity. In length of body it measures two feet; extent of wing, three feet and two inches. The sexes differ very little in coloration, both having the beautiful green spot on the wings.

PINTAIL (*Dafila acuta*)—called also SPRINGTAIL—is common to both continents, breeding in high latitudes, and wintering in Central America and Cuba.

The Pintail is especially fond of river and inland waters. It is an early visitor, reaching the northern boundary in September, with the Teal. Few of our water-fowl are so attractive, both in figure and coloration. The slender neck, graceful curve of body, and peculiar tapering of the tail-feathers give it features of extreme beauty, while the curious pencilling of the plumage is surpassingly pretty, reminding one of the markings on the gorgeous pinions of the Argus Pheasant. It has the reputation of being very shy and cautious. Dr. Coues testifies to its breeding in Montana, though it breeds largely in much higher latitudes. Hybrids of this with the Mallard are said to be of frequent occurrence. It is common in our markets in the season, and is much esteemed. It obtains its food without diving, feeding on the small mollusca of the flats. It is noisy and chattering in habit. Unlike some others of the tribe, when alarmed it seeks the company of its fellows, and they rise confusedly in a body, offering the best possible chance for the sportsman. About the middle of March they leave the Delaware for the North. The Pintail is twenty-six inches in length, and two feet ten inches in extent of wing. The female differs somewhat in the coloration from its mate.

GADWALL (*Chaulelasmus streperus*).—Called also GRAY DUCK. This species breeds in various parts of the United States, but does not seem to reach the extreme northern portions of the continent, like others of its tribe. Mr. Dall mentions it as found at Alaska, and Audubon saw it in Texas. Dr. Coues found its eggs in California. He also found it "quite common in Dakota in September, in company with Mallards, Teal and Widgeon; with unfledged young late in August." Wilson knew nothing of its particular manners or breeding-place. He says: "The flesh is excellent, and the windpipe of the male is furnished with a large labyrinth. It is very rare in the northern parts of the United States; is said to inhabit England in winter, and to migrate to Sweden, Russia and Siberia." This Duck is remarkable for presenting, next to the Shoveller, the greatest development of lateral lamina of the bill. It is also an expert diver. It utters a note similar to that of the Mallard, but louder; is fond of rush-grown ponds, feeding throughout the day, as well as morning and evening. The length of this bird is twenty inches; extent of wing, thirty-one inches; bill is two inches, formed much like that of the Mallard.

THE AMERICAN WIDGEON (*Mareca americana*).—Called also the BALD-PATE. Common along the Atlantic Coast as far north as Rhode Island. It is a constant attendant on the Canvas-back, and is consequently found plentifully in Chesapeake Bay, the favorite resort for the latter bird. It is said that the Widgeon never dives, yet is extremely fond of the tender roots of the aquatic plant upon which the Canvas-back feeds. Watching his neighbor, who is a good diver, the Widgeon snatches away a portion of the plant, giving rise, of course, to a continual quarrel. It feeds mostly in the evening, when it utters a peculiar whistle—a soft note, which is easily imitated by the sportsman. The flesh is considered excellent. It is thought by sportsmen that the Widgeon might easily be domesticated. It breeds in abundance in Dakota and Montana, and Audubon discovered it breeding in Texas. It is found as far south as Guatemala. The length is twenty-two inches, and extent of wing thirty.

GREEN-WINGED TEAL (*Querquedula carolinensis*).—Inhabits the whole of the United States, Greenland, Mexico and Cuba, and south as far as Honduras. It breeds from the northern border of the United States northward. It associates with the Mallard, flying in small flocks, and is essentially a fresh-water bird, being very abundant along the marshes of the Southern Atlantic States. Its flesh is prized highly. Length, fifteen inches; extent of wing, twenty-four.

BLUE-WINGED TEAL (*Querquedula discors*)—Plate VIII, fig. xviii.—Is found in most parts of North America, though chiefly east of the Rocky Mountains. It is on the Pacific Coast as far as Alaska; in Mexico and the West Indies, Central and South America and Ecuador. Wilson says that this bird is the first of its tribe that returns from the breeding-places in the north, usually showing itself early in September along the shores of the Delaware, where it sits on the mud close to the edge of the water. Its flight is rapid, and when it alights, drops down suddenly, like the Snipe or Woodcock, among the reeds or on the mud. It becomes very fat from feeding on the succulent plants among the reeds, at which time it is of excellent flavor. At times it is numerous on the Hudson, opposite the Catskill Mountains. This species measures fourteen inches in length and twenty-two in extent of wing. The speculum or beauty-spot, so-called, is of a brilliant metallic green, giving rise to the specific name.

CINNAMON-BREASTED TEAL (*Querquedula cyanoptera*).—This Teal is an inhabitant of South America, and in North America between the Rocky Mountains and the Pacific, as far north as the Columbia River; also in Louisiana and Florida. Prof. Baird observed, in 1852, that "this beautiful species is now for the second time presented as an inhabitant of North America. * * * It appears to be a common bird in Utah."

SHOVELLER (*Spatula clypeata*) — Plate 30, fig. 113.—Called also the SPOON-BILL, from its peculiar-shaped bill. Is found in North America generally, Europe, Asia, and in Australia. It breeds from Texas to Alaska, and winters from the Middle States southward to Guatemala. S. platalea, a nearly-allied species, is found in South America. The Shoveller is abundant in all parts of the Western States. It is a beautifully marked bird, and is much prized as food. It seldom visits the sea-coast, being more fond of the interior lakes and rivers, especially along the muddy shores, where it finds the larvæ of insects. The fine teeth of its bill serve to filter the muddy water in which it searches for food. The Shoveller is twenty inches long, and two feet six inches in extent. The bill is three inches in length, and greatly widened at its extremity. It is closely pectinated on

its sides, and is furnished with a nail on the tip of its mandible. The irides are bright orange.

SUMMER DUCK; WOOD DUCK (*Aix sponsa*)—Plate VIII, fig. xvii.—This is the queen of water-birds, and the most beautiful of all, its resplendent plumage being hardly excelled by any of its class in tropical regions. It is found more particularly in the United States, yet ranges in every part of the continent, breeding in nearly every quarter, and wintering chiefly in the south. This is essentially a bird of the interior, as its name imports, being found usually on the banks of quiet streams or ponds, away from the haunts of man. Another characteristic is that it builds its nest on trees. Audubon says: "They breed in the Middle States about the middle of April; in Massachusetts, a month later; and in Nova Scotia and on the great lakes, not before the first days of June. In Louisiana and Kentucky, where I have had greater opportunities of studying their habits in this respect, they generally pair about the first of March, sometimes a fortnight earlier. I never knew one of these birds to form a nest on the ground, or on the small branches of a tree; they appear at all times to prefer the hollow, broken portion of some large branch, the hole of our large Woodpecker, or the deserted retreat of the Fox Squirrel; and I have frequently been surprised to see them go in and out of a hole of any one of these, when their bodies, when on wing, seemed to be nearly half as large again as the aperture in which they had deposited their eggs. Once only I found a nest in the fissure of a rock. Generally the holes in which they lay are over cane-brakes, in deep swamps, or in broken branches of high sycamores. No sooner has the female completed her set of eggs than the male disappears, joining others until the young are able to fly, when they rejoin their mates, and so remain until the commencement of the next breeding season. On coming to a nest when the female is away in search of food, I always found the eggs covered by down and feathers, although quite out of sight, in the depth of a hole. If the nest is placed immediately over the water, the young, immediately when hatched, scramble to the mouth of the hole, and spread their tiny wings and feet, and drop into the water; but whenever the nest is away some distance from a stream, the mother takes them tenderly in her bill, one at a time, and carries them to their favorite element. On several occasions they led them to the stream, when it was not far distant, calling *Pe-pe, pe-e!* often and rapidly." The Summer Duck is nineteen inches in length, and two feet four inches in extent of wings. The bill is red, margined with black.

GREATER SCAUP DUCK (*Fuligula marilla*).—This bird is also called BIG BLACK-HEAD, BLUE-BILL and SHUFFLER. It inhabits the whole of North America Greenland, and Europe and Asia. The Scaup is, said to obtain its name from the circumstance of its feeding on a fresh-water plant of that name. It is, however, common to the salt as well as fresh-waters, feeding also on small snails, which, like others of its tribe, it does by moonlight. The flesh is not esteemed as highly as others. This species is well-known in England and the northern parts of Europe. Length, nineteen inches; extent of wing, twenty-nine. The bill is broad, generally of a light blue; irides reddish.

LESSER SCAUP DUCK (*Fuligula affinis*).—Called in some localities LITTLE BLACK-HEAD, BLUE-BILL and BROAD-BILL. Dr. Coues says: "Authors are at variance concerning the relationship of this bird to the preceding, and the question is not yet settled. For myself, I am rather inclined to keep the two apart, notwithstanding their very close resemblance, and admitting the probability that intermediate examples may be found. There appears to be something different in their range, the F. affinis being the more southerly. Not that it does not, in the breeding season, reach as high latitudes as the other, but that its autumnal movement is pushed to the West Indies and Central America, where the true F. marilla is not recorded as occurring. It is improbable that two varieties, if they be really such, should preserve this difference. Good observers have also noticed some differences in habit and resorts; and gunners, practically very familiar with both birds, recognize a distinction. The Lesser Black-head seems to be more generally distributed in the interior of the United States than the other, and probably most of the 'Scaups' from that region are of this kind. All of the numerous 'Scaups' I found breeding along the Upper Missouri and Milk River appeared to be of this species, as were the several specimens examined. In some places they seemed more abundant than any other species, and they were the principal representatives of the *Fuligulinæ*, the Buffle-head itself not excepted."

RING-NECK DUCK (*Fuligula collaris*).—Inhabits the whole of North America, breeds far north, winters in the United States and beyond, south to Guatemala, Cuba, Jamaica, and is accidental in Europe. This bird is described in Wilson's work as Anas fuligula, and in common terms as the Tufted Duck. It seldom visits the sea-shore, but frequents the fresh-water streams of the interior. The flesh is somewhat esteemed for its tenderness and pleasant taste. The length of this Duck is seventeen inches; extent of wing, two feet two inches. The bill is broad and dusky in color, and the head is crested, of a black color, with reflections of purple.

AMERICAN POCHARD (*Fuligula ferina*), also called the RED-HEAD, is found in all parts of North America, but is particularly plentiful in eastern portions; breeding in the fur countries, and found wintering in the Bahamas. During a residence of eight years on the Tortugas, we noticed one only, which we captured. It is well known as the second in rank to the Canvas-back as an edible; indeed, many are sold under the latter name. The Red-head, when fat, is so excellent that it is not easy always to determine the difference. The two associate, and frequent the fresh waters about the James River and Chesapeake Bay, feeding on a species of fresh-water plant that is said to impart a decided flavor to the flesh.

CANVAS-BACK (*Fuligula vallisneria*)—Plate VIII, fig. xix—is the most royal game bird of America. It inhabits the whole of North America, breeds from the Northern States northward, and winters from the Middle States southward to Guatemala. Wilson says: "This celebrated American species, as far as can be judged from the best figures and descriptions of foreign birds, is altogether unknown in Europe. It approaches nearest the Pochard of England (*Anas ferina*), but differs from that bird in being superior in size and weight, in the greater magnitude of its bill, and the general whiteness of its plumage. The Canvas-back arrives in the United States from the north about the middle of October; a few descend to the Hudson or Delaware, but the greater body resort to the streams and inlets belonging to or in the neighborhood of the Chesapeake Bay, particularly the Susquehanna, the Patapsco, the Potomac and James Rivers, which appear to be their general winter quarters. Like all birds that man becomes familiar with, they have been called by numerous local names. In the Potomac they are the 'White-backs'; on the James they are 'Sheldrakes.' They are seldom found at a great distance up any of these rivers, or even in the salt-water bay, but in that particular part of the tide-water where a certain grass-like plant grows, on the roots of which they feed. This plant, which is said to be a species of vallisneria, grows on fresh-water shoals of from seven to nine feet, in long, narrow, grass-like blades of four or five feet in length; the root is white, and has some resemblance to small celery. This grass is in many places so thick that a boat can with difficulty be rowed through it. The shores are lined with large quantities of it, torn up by the Ducks, and drifted up by the winds, lying, like hay, in winnows. Wherever this plant grows in abundance there will be found the Canvas-back Duck, and in no other locality during the season. On the first arrival of these birds on the Susquehanna they are generally lean, but such is the abundance of their favorite food, that towards the beginning of November they are in pretty good order. They are excellent divers, and swim with great speed and agility. They sometimes assemble in such multitudes as to cover several acres of the river, and, when they rise suddenly, produce a noise resembling thunder. They are extremely shy, and can rarely be approached unless by stratagem. When wounded in the wing they dive to such prodigious distances, and with such rapidity, continuing it so perseveringly, and with such cunning and active vigor, as almost always to render the pursuit hopeless. From the great demand for these Ducks, and the high price they uniformly bring in the market, various modes are practiced to get within gun-shot of them. The most successful way is said to be decoying them to the shore by means of a dog, while the gunner lies closely concealed in a proper situation. The dog, if properly trained, plays backwards and forwards along the margin of the water; and the Ducks, observing his manœuvres, enticed perhaps by curiosity, gradually approach the shore, until they are sometimes within twenty or thirty yards of the spot where the gunner lies concealed, and from which he rakes them, first on the water, and then as they rise. This method is called *tolling them in.* If the Ducks seem difficult to decoy, any glaring object, such as a red handkerchief is fixed round the dog's middle, or to his tail, and this rarely fails to attract them. Sometimes by moonlight the sportsman directs his skiff towards a flock whose position he had previously ascertained, keeping within the projected shadow of some wood, bank, or headland, and paddles along so silently and imperceptibly as often to approach with fifteen or twenty yards of a flock of many thousands, among whom he may make great slaughter. During the day they are dispersed about, but towards evening they collect in large flocks, and ride as at anchor in the mouths of creeks. If shot at much in the night, they are apt to be dispersed, and not return. When feeding and diving in small parties, the whole never go down at one time, but some are still left alone on the lookout. When the winter sets in severely, and the river is frozen, the Canvas-backs retreat to its confluence with the bay, occasionally frequenting air-holes in the ice, which are sometimes made for the purpose, immediately above their favorite grass, to entice them within gun-shot of the hut or bush, which is usually fixed at a proper distance, and where the gunner lies concealed, ready to take advantage of their distress. The Canvas-back, in the rich, juicy tenderness of its flesh, and its delicacy of flavor, stands unrivalled by the whole of its tribe in this and perhaps any other quarter of the world. Those killed in the waters of the Chesapeake are considered superior to all others, doubtless from the greater abundance of its favorite food which these produce."

The Canvas-back is two feet long, and three in extent of wing, and when in good order weighs three pounds; the female is somewhat less, weighing two and three-quarters pounds. The windpipe of the male has a large, flattish, concave labyrinth. The intestines are wide, and measure five feet. Dr. Coues says: "The Canvas-back does not seem to nest in the Eastern States, though it does so in the West." He found younglings, in July, on Turtle Mountains, latitude forty-nine degrees. Dr. Newberry found it more numerous than any other Duck in the lakes and streams of the Cascade Mountains. In those solitudes it nests and rears its young, as he frequently saw its broods. Mr. Dall found it breeding in abundance on the Yukon.

GOLDEN-EYE (*Bucephala clangula*).—Called, also, WHISTLE-WING and GARROT. Inhabits all of North America, Cuba and Europe. Wilson says: "It frequents the sea-coast, and about the lakes and rivers of the interior; associates in small parties, and may easily be known by the vigorous whistling of its wings as it passes through the air. It swims and dives well, but seldom walks on shore, and then in a waddling, awkward manner, feeding chiefly on shell-fish, small fry, etc. The flesh is less esteemed than that of the preceding." In the United States they are only winter visitors, leaving us again in the month

of April, being then on their passage to the north to breed. They are said to build, like the Wood Duck, in trees. The Golden-Eye is nineteen inches in length, and twenty-nine in extent of wing, and has the singular conformation of windpipe seen in the last-named, with more irregular development.

BARROW'S GOLDEN-EYE (*B. islandica*), called, also, the ROCKY MOUNTAIN GARROT, is found all through North America, northerly; south to New York and Utah, Greenland and Iceland; also in Europe. Dr. Coues says it probably breeds in the Rocky Mountains of the United States. The same authority says: "Notwithstanding the doubt which has been cast by myself, among others, regarding this bird, it appears, nevertheless, to be a valid species; the differences pointed out being apparently constant, as well as appreciable, and there being, moreover, certain anatomical peculiarities in the form of the skull, of which I only lately have become aware. Originally described in 1788, and subsequently re-named and figured in 1831. The species was ignored by Audubon, who mistook it for the summer plumage of the common Golden-Eye. It is the most northerly species of the genus, having probably a circumpolar distribution, breeding only (?) in high latitudes, and penetrating but a limited distance south in winter. Its claim to a place in its present connection rests upon its occurrence in the Rocky Mountains, and as far south as Utah, where it was procured by M. H. W. Henshaw. On the east it occurs as far south, in winter, as New York."

DIPPER; BUFFLE-HEAD (*B. albeola*).—This species—called, also, the BUTTER-BALL and SPIRIT DUCK, the latter name from its quick movements when diving—inhabits the whole of North America, chiefly coastwise, northerly, and moving south in winter to Mexico and Cuba. It breeds in the Turtle Mountains of United States. Wilson says it is common to the sea-shores, rivers and lakes of the United States in every quarter of the country during autumn and winter. The Buffle-head, or Buffalo-head, so called from its disproportionately-sized head, is fourteen inches in length, and twenty-three inches in extent of wing. The bill is short, of a light blue, or leaden color. The plumage of the head and half of the neck is thick, long and velvety, projecting greatly over the lower part of the neck. This plumage on the forehead and nape is rich glossy green, changing into a shining purple on the sides and crown. From the eyes backwards passes a broad band of pure white; iris of the eye, dark; back, wings, and part of the scapulars, black; rest of scapulars, lateral band along the wing, and whole breast, snowy white; belly, vent, and tail coverts, dusky white; tail pointed, and of a hoary color. The female is less than the male, and destitute of the tumid plumage of the head.

HARLEQUIN DUCK (*Histrionicus torquatus*) is found in North America, northerly, and mostly coastwise, moving southward to the Middle States and California in winter. The male of this species is called, in New England, *lord;* the female, *lady;* probably, as Wilson says, from the elegant crescents and circles of white which ornament the neck and breast. Though an inhabitant of both continents, little else is known of its particular manners than that it swims and dives well, flies swift and to a great height; has a whistling note, and is said to frequent the small rivulets inland from Hudson's Bay, where it breeds. The female lays ten white eggs on the grass, and the young are prettily speckled. It is found on the eastern continent as far south as Lake Baikal, and thence to Kamtschatka, and was also met with in Iceland. At Hudson's Bay it is called Painted Duck. Coues says it breeds in the Northern Rocky Mountains. In August, 1874, he found broods there still unable to fly.

OLD-WIFE (*Harelda glacialis*).—This is the most common and familiar bird of the tribe that visits the New England Coast in winter. It is also known by the names LONG-TAILED DUCK, and in Chesapeake Bay as SOUTH-SOUTHERLY, its cry being said to resemble the sound of those words. It is chiefly a salt-water species, and seldom rambles far from the sea, inhabiting our bays and coasts in winter only. It is rarely found in marshes, but frequents the channels, diving for small shell-fish, which are its principal food. In passing to and from the bays, sometimes in large flocks, particularly towards evening, their loud and confused voices may be heard, in fair weather, at the distance of several miles. They fly very swiftly, take short excursions, and are lively, restless birds. Their native regions are in the north, where great numbers of them remain during the whole year, part only of the vast family migrating south to avoid the severest rigors of that climate. They are common to the whole northern hemisphere. In the Orkneys they are met with in considerable flocks, from October to April; frequent in Sweden, Lapland and Russia, and are often found about St. Petersburg. They are said to breed in Hudson's Bay, making their nests among the grass near the sea, like the Eider Duck, and about the middle of June lay their eggs. When the young are hatched, the mother carries the young to the water in her bill. The nest is lined with the down of her breast, which is accounted equally valuable with that of the Eider Duck. They are hardy birds and excellent divers. Their flesh is not esteemed, being too fishy in flavor. The length is twenty-two inches, and in extent of wing thirty. The windpipe is very curiously formed; besides the labyrinth, which is nearly as large as the end of your thumb, it has an expansion above that of double the usual diameter, which continues for an inch and a half; this is flattened on the side next the breast, with an oblong, window-like vacancy in it, curved with five narrow bars, and covered with a thin transparent skin, like the panes of a window; another thin skin of the same kind is spread over the external side of the labyrinth, which is partly of a circular form. This singular conformation is, as usual, peculiar to the male.

LABRADOR DUCK (*Camptolæmus labradorius*).—The habitat of this Duck is considered to have been the north-eastern coast of North America, not farther south than New Jersey. It is considered to be extinct, as no specimens are now obtained.

EIDER DUCK (*Somateria mollissima*)—Fig. 132, vol. i, p. 423).—The habitat of this Duck, so celebrated for its down, ranges over the Atlantic and Arctic Coasts. According to Wilson, the quantity of down found in one nest more than filled the crown of a hat, yet weighing no more than three quarters of an ounce; and it is asserted that three pounds of it may be compressed into a space scarce bigger than a man's fist, yet is afterwards so dilatable as to fill a quilt five feet square. Some specimens of this bird have been known to breed near Portland, in Maine, this being their most southern abiding-place. Greenland and Iceland abound with them, and here, in particular places, the nests are crowded so close together that a person can scarcely walk between them. They associate together in flocks, generally in deep water, diving for shell-fish, which constitute their principal food. In Labrador they are numerous, and are occasionally seen as far south as Delaware. The flesh is esteemed by the inhabitants of the northern countries, but it is very fishy in flavor. The length is two feet three inches; extent of wing, three feet; weight, between six and seven pounds. The head is large, and the bill of singular structure, being three inches in length, forked in a remarkable manner, running high up in the forehead, between which the plumage descends nearly to the nostrils. The whole of the bill is of a dull yellowish horn color, somewhat dusky in the middle; upper part of the head, deep velvet-black, divided laterally on the hind-head by a whitish band; cheeks are white; sides of the head, a pale pea-green, marked with a narrow line of white, dropped from the ear-feathers. The plumage of this part of the head to the throat is tumid, and looks as if cut off at the end, for immediately below the neck it suddenly narrows, somewhat in the manner of the Buffle-head, enlarging again greatly as it descends, and has a singular hollow between the shoulders behind. The upper part of the neck, back, scapulars, lesser wing covers, and sides of the rump are pure white; lower part of the breast, vent and belly, black; tail, primaries, and secondaries, brownish-black; the tertials curiously curved, falling over the wing; legs short and yellow; webs of the feet, dusky. The difference in color of the male and female is singularly great. The female is considerably less than the male, and the bill does not rise so high in the forehead. The general color is a dark reddish-drab, mingled with lighter touches, and everywhere spotted with black; wings dusky, edged with reddish. The greater coverts, and some of the secondaries, are tipped with white; tail brownish-black, lighter than in the male. The plumage in general is centred with bars of black, and broadly bordered with rufous-drab; cheeks, and space over the eye, light drab; belly dusky, and obscurely mottled with black; legs and feet as in the male. Van Troil, in *Letters on Iceland*, observes: "The young ones quit the nest soon after they are hatched, and follow the female, who leads them to the water, where, having taken them on her back, she swims with them a few yards, and then dives, leaving them floating on the water. In this situation they soon learn to take care of themselves, and are seldom seen on the land, but frequent the rocks, and feed on seaweed and such insects as are found there."

SPECTACLED EIDER (*S. fischeri*).—This species, known only on the North-west Coast, is a large bird, measuring about two feet in length. It has a broad white space around the eye, surrounded by a ring of black, which gives rise to the specific name.

KING EIDER (*S. spectabilis*).—This is found as far south on the Atlantic as New York (rarely). The Pacific Eider (*S nigra*) is about the same in size, and is precisely like S. mollissima, with the exception of a V-shaped black mark on the chin.

STELLER'S DUCK (*S. stelleri*).—This species is confined to the North-west Coast of America, and is about eighteen inches in length, and eight inches in extent of one wing. It bears the name of Western Duck on some portions of the coast.

VELVET DUCK (*Oidemia americana*).—This is a very beautiful species, common on the coast of New England in winter. It is found on both coasts of North America, and in the larger inland waters. The flesh is not esteemed on account of its fishy flavor. The Scoter Duck, with which it often associates, is confounded with this species by gunners. The habits of both are very much alike. They visit us only in winter, feeding on the shell-fish that they find in the deep water off the shores. The Velvet Duck measures twenty-three inches in length, and two feet nine inches in extent of wing, and weighs three pounds.

VELVET SCOTER DUCK (*O. fusca*) is an occasional visitor on the New England Coast, its usual habitat being more northerly. Its food is shell-fish, for which it is almost perpetually diving. It flies heavily, but swims with the greatest ease, even in the heaviest surf, hence it is sometimes called Surf Duck. The Scoters are said to appear on the Coast of France in great numbers, to which they are attracted by a certain kind of small bivalve, called *vaimeaux*. Over beds of these shell-fish the fishermen spread their nets, supporting them horizontally at the height of two or three feet from the bottom. At the flowing of the tide the Scoters approach in great numbers, diving after their favorite food, and soon get entangled in the nets. Twenty or thirty dozen have sometimes been taken in a single tide. These are sold to the Roman Catholics, who are forbidden to eat animal food on a certain day, fish excepted. These birds, and a few others of the same fishy flavor, have been exempted from the interdict on the supposition that they are cold-blooded, and partaking of the nature of fish. The Scoter measures twenty-one inches in length, and thirty-four in extent of wing. The female is of a sooty-brown, and has none of the knob on the bill.

SURF DUCK; SEA COOT (*O. perspicillata*).—This is a handsome bird in its winter state, its black velvet plumage being exceedingly attractive, while its orange-colored bill presents a rich contrast. It breeds in Labrador, and visits the New England Coast in winter. The flesh of this and other nearly allied species is not good, on account of the diet consisting exclusively of fish.

RUDDY DUCK (*Erismatura rubida*) has a habitat ranging over the whole of North America south to Guatemala, where it has been found breeding. It is also found in Cuba. Wilson regarded this as a very rare Duck. Dr. Coues found it breeding in numbers in the pools about Turtle Mountains, in Dakota, where the young were swimming in July. He also saw it during the breeding season in Montana. It is fifteen inches in length, and twenty-two in extent of wing. The bill is broad at the tip, the under mandible much narrower, and both of a light rich blue. A species, called the St. Domingo Duck (*E. dominica*), is a native of the West Indies, and occasionally found on our continent.

SHELDRAKE (*Mergus merganser*)—also called MERGANSER, FISHING DUCK, and GOOSANDER—has a range throughout North America generally, usually associating in small numbers of six or eight, and is a most persistent diver. The male is twenty-six inches in length, and three feet three inches in extent of wing. The bill, which is slender and cylindrical, measures three inches in length, and nearly one inch thick at the base, is serrated on both mandibles, the upper overhanging at the tip, where each is furnished with a large nail. The ridge of the bill is black; the sides, crimson; irides, red.

HOODED MERGANSER (*M. cucullatus*)—called HAIRY-HEAD in some localities—is one of the most striking birds, on account of its singular hood-like appendage on the top of the head. Its habitat is the whole of North America. They are more common along the lakes and fresh-water rivers than near the sea, being found up the various creeks and mill-ponds, where they dive incessantly for shell-fish. In the creeks and rivers of the Southern States they are common during the winter. The Hooded Merganser is eighteen inches in length, and two feet in extent of wing. The bill is blackish-red, narrow, thickly toothed, and furnished with a projecting nail at the extremity. The large circular crest with which the head is ornamented may be raised or depressed. The windpipe has a small labyrinth. The female is less in size, with a smaller crest of a light rusty color. This species is peculiar to America, arriving at Hudson's Bay about the end of May. It builds close to the lakes, the nest being composed of grass, lined with feathers from the breast.

FAMILY—SULIDÆ.

THE GANNETS.

The Gannets are large and heavy birds. They are not numerous in species, six only being known, and these are pretty well distributed throughout the world. They are very gregarious in habit, congregating in immense numbers in their breeding places.

THE COMMON GANNET (*Sula bassana*).—This species extends, on the Atlantic Coast, from the high latitudes to the Gulf of Mexico, but is not found on the Pacific shore. Its length is about thirty inches; extent of wings, sixty inches. The adult bird is pure white. The young are gray, mottled or spotted with white.

BOOBY GANNET (*S. fiber*) is peculiarly a tropical species, being exceedingly frequent in the harbors and bays of the Southern Coast. It is considerably smaller than the last. A constant habit of this bird is to roost on the buoys of the outer harbors. Certain individuals take up their abode there, and may always be counted on being found at their post. We have noted this, particularly when some accidental injury to the bird betrayed his identity.

FAMILY—PELECANIDÆ.

PELICANS.

WHITE PELICAN (*Pelecanus trachyrhynchus*).—This bird has a range northward as far as latitude 61°, and possibly farther. It is rare in the Middle States and New England, but abundant in the interior, especially west of the Mississippi and south as far as Texas and Northern Florida. In South Florida, where the Brown Pelican is abundant, it is not known. It formerly bred in great numbers about the Great Salt Lake, but has lately decreased in numbers. Mr. Ridgway saw vast numbers nesting about Pyramid Lake, in Nevada, where he procured over a hundred eggs. He has shown that the crest of the Pelican is shed in a manner somewhat similar to the casting of a deer's horn. The breeding range of the species is said to be very extensive. Audubon's account of this bird is interesting: "Ranging along the margin of a sand-bar, in broken array, stand a hundred heavy-bodied Pelicans. Gorgeous tints, all autumnal, enrich the foliage of every tree around, the reflection of which, like fragments of a rainbow, seems to fill the very depths of the placid and almost sleeping waters of the Ohio. The subdued and ruddy beams of the orb of day assure me that the Indian summer has commenced—that happy season of unrivalled loveliness and serenity, symbolic of autumnal life, which to every enthusiastic lover of nature must be the purest and calmest period of his career. Pluming themselves, the gorged Pelicans patiently await the return of hunger. Should one chance to gape, the whole number, as if from sympathy, in succession open their long and broad mandibles, yawning lazily and ludicrously. Now, the whole length of their largest quills is passed through the bill, until at length their apparel is as beautifully trimmed as if the party were to figure at a route. But mark the red beams of the setting sun tinge the tall tops of the forest trees. The birds experience the cravings of hunger, and to satisfy them they must now labor. Clumsily they now rise on their columnar legs, and heavily waddle to the water. But now how changed do they seem! Lightly do they float, as they marshal themselves and extend their line, and now their broad paddle-like feet propel them onward. In yonder nook the small fry are dancing in the quiet water—perhaps in their own manner bidding farewell to the orb of day—perhaps seeking something for supper. Thousands there are, all gay, and the very manner of their mirth, causing the waters to sparkle, invites their foes to advance towards the shoal. And now the Pelicans, aware of

the faculties of their scaly prey, at once spread out their broad wings, press closely forward with powerful strokes of their feet, drive the little fishes towards the shoal, and then, with their enormous pouches, spread like so many bag-nets, scoop them out and devour them in thousands. The White Pelicans never dive upon their prey as the Brown Pelicans do, but skim along the surface, and dip up any prey that they are expert enough to reach. They swim along against the current and wind, with their wings partially extended, and the neck stretched out, the upper mandible alone above water, while the lower must be used as a scoop-net, as I saw it raised from time to time and brought to meet the upper, when the whole bill immediately fell to a perpendicular position, the water was allowed to run out, and the bill being again raised upwards, the fish was swallowed. After thus swimming for a hundred yards in an extended line, and parallel to each other, they would rise on wing, wheel about, and re-alight at the same place where their fishing had commenced, when they would repeat the same actions. The usual manner of flight is similar to that of the Brown Pelican." The White Pelican is not so well known as the Brown, probably from the fact that the latter is more frequently seen by those who are voyagers in tropical waters.

BROWN PELICAN (*P. fuscus*).—This is the most interesting, as it is the most common of the genus in our country. It is rarely seen farther east than Cape Hatteras, but is exceedingly numerous on the shores of the Gulf of Mexico, and does not, like the White Pelican, enter the fresh-water streams. It was formerly abundant in the harbor of Charleston, S. C., but is now seldom seen there. On the Keys of the Florida Reef these birds are especially at home. During a residence at the Tortugas the author had opportunity to notice the habits of the species. On a sea-beaten islet of coral, that lies exposed to the breakers of the Gulf Stream, were several small mangroves—mere shrubs. On the tops of these several Pelicans found a home, their nests being constructed very rudely of coarse sticks and bits of coral, scarcely lined with anything more delicate. Two white and chalk-like eggs were the usual complement. The nests were built on the extreme topmost branches, and when the female alighted on its nest, the whole structure seemed to be in danger of coming to the ground. The young of the Brown Pelican are first covered with a cream-colored down, and have the bill and feet disproportionately large.

FAMILY—PLOTIDÆ.

ANHINGA (*Plotus anhinga*). — Called in the Southern States SNAKE-BIRD and BLACK-BELLIED DARTER. This bird is common in Florida and the Gulf States. Its length is three feet three inches, with a bill three and three-quarters inches in length, the latter very slender and very sharp-pointed, and armed with numerous sharp teeth toward the tip for securing its prey. It is black above and yellow beneath; no external nostrils are visible. The whole plumage is of an extraordinary stiffness and elasticity; that of the neck and breast soft, thick and shining. The position of these birds, when standing, is like that of the Gannets. Formerly the Darter was considered an anomalous production of some fanciful trader—a monster, partaking of the nature of a Snake and a Duck—and some ancient charts delineate it in all the extravagance of fiction. Mr. Bartram says "They are to be found in all the rivers of Florida. The people call them Snake-birds. I think I have seen paintings of them on Chinese screens and other Indian pictures. They delight to sit in little peaceful communities, on the dry limbs of trees, hanging over the still waters with their wings and tail expanded—I suppose to cool and air themselves, when at the same time they behold their images in the watery mirror. At such times, when we approach them, they drop off the limbs into the water as if dead, and for a minute or two are not to be seen; when on a sudden, at a great distance, their long, slender head and neck appear, like a snake rising erect out of the water, and no other part of them is to be seen when swimming except sometimes the tip end of their tail. In the heat of the day they are seen in great numbers, sailing very high in the air over lakes and rivers." They feed entirely on fish. Their flesh is intolerable, and no one would, as Audubon says, eat of it unless constrained by starvation. Mr. Abbott says these birds frequent the ponds, rivers and creeks during the summer; build in the trees of the swamps, and in those of the islands in ponds. They construct their nests of sticks. The eggs are of a sky-blue color. They are sometimes called Sun-birds, on account of their habit of sitting with wings unfolded, as if "sunning" themselves.

FAMILY—TACHYPETIDÆ.

THE FRIGATE BIRD (*Tachypetes aquila*)—Plate IX, fig. xxii.—This is the only species of the family known on our coast, and is possibly the same as that in the southern half of the continent. It is strictly a maritime bird, and one that exhibits the most wonderful powers of flight. During a long residence on the Florida Reef, where this bird is more at home than on any other portion of the North Atlantic shores, we have observed very carefully its habits. In the cooler season, numbers of the Man-of-war Bird, as it is called there, were seen at certain times soaring above the Fortress Jefferson, on the Tortugas Keys. As these birds seemed to present the most remarkable example of the buoyancy or other conditions that serve to sustain them in air for long periods without seemingly any wing movements, we improved the opportunity to test, so far as was possible, the philosophy of the phenomenon. An old-fashioned light-house tower was yet standing within the fortress, and this enabled the observer to be about seventy-five or eighty feet from the ground. With a good glass and careful concealment in the lantern-top, a very near view was obtained. Humboldt and Darwin—the latter in *The Voyage of the Beagle*—have given some attention to the subject.

but express an inability to comprehend it. The fact that these birds soar, or remain apparently motionless, only when the wind is considerable, seems to have escaped their notice. For therein lies the secret. The Tachypetes represents the most spread of wing and the least proportionate body of any bird, and is, consequently, one that possesses the greatest faculty for maintaining the curious position in mid-air. Another fact is, the bird always faces the wind. We have, then, the same conditions as in the case of a boy's kite. The bird is well represented by a kite. It rises precisely as a kite does, and it moves only as it does—not by any movement of feathers, but a gentle swaying, and a trifle of tilting on the wind, to maintain its balance. What keeps it from being blown away—for the kite has its string? The intelligence of the bird causes it to tilt forward just enough to counteract the force of the wind, and thus the smallest possible space is presented to the wind; it is merely a thin edge. Tipping forward causes the body to fall against the wind; the two forces—gravity and the wind—are opposed, and a perfect rest is the result. The writer received a note from Mr. Darwin, in answer to one suggesting this explanation. In this answer he says: "I have thought of some such explanation, but the mathematicians say that it is not possible; that the two forces do not operate in a direct line, opposite to each other." Now, there is the qualifying power of buoyancy, which operates to prevent the bird from dropping directly down like dead weight. We must regard the bird as it is—a thin, exceedingly light object, that is kept up by a strong wind, and that by its intelligent attention to keep the outspread wings and body rigid and always edgewise to the wind, with a slight tendency downward. These conditions observed, the bird *rests* upon the wind, as the kite does, the force of gravity operating as the string. It is not uncommon to see a stiff piece of paper balanced in air by the wind, and when inclined even directly against the wind, to shoot forward until it goes obliquely to the ground. Now, could this paper, just at the moment of falling, while inclined against the wind, act to tilt its face a trifle, the wind would send it backwards and upwards again. Thus, if the two forces were opposed by intelligent action, the result would be as in the bird, a complete balancing on the wind. The very close range at which these birds were observed made it possible to determine that *no* movement whatever took place among the wing feathers.

FAMILY—PHÆTONIDÆ.

TROPIC BIRDS.

Birds of this family seem to have been distinguished by this name without any especial reason. They are much like a stout Tern in figure. The principal external characteristic is the development of the two middle tail-feathers into long plumelets.

TROPIC BIRD (*Phæton flavirostris*).—This is a beautiful white, satiny, rose-tinted bird, of graceful flight, and one that is especially regarded by seafaring people as a friendly visitor and companion while at sea. It is rare with us, but is occasionally met with on the Florida shores.

FAMILY—GRACULIDÆ.

DOUBLE-CRESTED CORMORANT (*Graculus dilophus*)—commonly called SHAG.—Inhabits the whole of North America, in the interior as well as coastwise. In this respect it differs from all other species. Audubon records a variety (G. floridianus) as far north as Ohio, and Dr. Coues in North Carolina. It has been found breeding in Labrador and the Gulf of St. Lawrence, whence it migrates south in the fall, wintering along the coast of Maine to the Carolinas. It has been noticed at Great Salt Lake, in the interior. It forms its nest of sea-weeds, sticks, moss, and clods of earth with grass adhering to them, which it piles up into a solid mass, often as high as three feet from the rock, with a diameter of eighteen inches at the top and of two and a half feet at the base. The whole has an appearance of solidity such as is seldom seen in nests of waterbirds. The nests are placed as near each other as the nature of the ground will permit. The flight of this bird is strong and well-sustained, although not so rapid as that of the Florida Cormorant. It sails at times in a beautiful manner, and at a great height over the waters. Like other species, they are fond of sunning themselves with their wings spread out. They walk awkwardly, and cannot run except with their wings spread out. When rising to fly from the water, they are obliged to run and beat their wings on the surface for a time before they can rise. The length is, to the end of the tail, thirty-three inches; extent of wing, fifty-one inches; weight, five pounds and seven ounces.

MEXICAN CORMORANT (*G. mexicanus*).—This bird has a habitat in the Southern States and southward. It has been noticed up the Mississippi River as far as Illinois. It is also found in Cuba.

COMMON CORMORANT (*G. carbo*).—This bird is abundant on the Labrador Coast, where great numbers gather to breed. Its length is thirty-seven inches. It reaches as far south as New Jersey in winter.

PALLAS' CORMORANT (*G. perspicillatus*) is found in Russian America. Its length is thirty-six inches.

THE TUFTED CORMORANT (*G. cincinnatus*) is found on the North-west Coast, at Sitka. Its length is about thirty-six inches.

BRANDT'S CORMORANT (*G. penicillatus*) is common on the Pacific Coast of North America. Length about twenty-eight inches.

THE VIOLET-GREEN CORMORANT (*G. violaceus*) is only found on the West Coast, southward to California. Its length is about twenty-eight inches.

FAMILY—LARIDÆ.

THE GULLS.

THE SKUA (*Stercorarius skua*).—This bird has a habitat throughout the seas of North America, but chiefly in the more arctic regions. A variety, antarcticus, is found in the Southern Ocean.

JAGER; THE POMARINE JAGER (*Stercorarius pomatorhinus*).—Inhabits the seas and sea-coasts of Europe, America and Asia, and is also found in the interior of North America. It is called also the GULL-HUNTER. The female has a length of twenty and a quarter inches, and an extent of wing of forty-eight inches. Its eggs are two or three in number, and of a grayish-olive, marked with blackish spots.

THE PARASITIC JAGER (*S. parasiticus*).—Found in the North Atlantic and on the sea-coast of Europe and America, and in the interior of Arctic America. It has the reputation of being a constant terror of the smaller Gulls. Few birds surpass it in power and length of flight. It generally passes through the air at a height of fifty or sixty yards, flying in an easy manner, ranging over the broad bays, on which Gulls of various kinds are engaged in procuring their food. As soon as he observes that a Gull has secured a fish, he gives chase. The superior powers of the Jager soon prevail, and the Gull disgorges. After a short respite, while he disposes of his stolen meal, he looks about him for more game, and sallies forth to renew the robbery. When on wing, the beautiful long tail-feathers seem to offer this bird a ready means of turning quickly. It is usually seen singly, or at most, in pairs; but Audubon says: "I observed it on the Florida Keys in flocks of ten to fifteen, congregated as if for the purpose of returning to the northern regions, where it is said to breed in groups. It breeds in several of the Orkney Islands, and is gregarious during that period; and the situations selected for breeding are the unfrequented heaths, some distance from the shore. At this time it is very courageous, and attacks every intruder by pouncing upon him, and striking with the bill and wings."

BUFFON'S JAGER (*S. buffoni*).—Called also the LONG-TAILED JAGER. Inhabits the coasts of North America and Europe, mostly in high latitudes, and is found in the interior of Arctic America.

RICHARDSON'S JAGER (*S. richardsoni*).—This is a rare bird on the coast of the United States below Massachusetts. It is shy, and difficult to approach. Its flight is extremely rapid, and, like other species, it harasses the small Gulls. It breeds in the northern grounds, away from the coast. Its length, from bill to end of tail, eighteen and a half inches; extent of wing, forty inches. This Jager has a bill of grayish-black, the upper portion bluish; iris is brown.

BURGOMASTER GULL (*Larus glaucus*). — Called also the GLAUCOUS GULL. It is found in the Northern and Arctic seas, is circumpolar in its range, and reaches in winter as far south as Long Island. The Burgomaster is one of the largest of our Gulls. Dr. Richardson says: "This large and powerful Gull is considered rare in the United States. It is notoriously greedy, feeding not only on fish and small birds, but on carrion of every kind. One specimen, captured by Capt. Ross, disgorged an Auk, and proved, on dissection, to have another in its stomach." It is rather a shy and inactive bird, and has little of the clamorousness of other species. They vary greatly in size, and on that account are sometimes confounded with the L. marinus. The eggs are a pale purplish-gray, with scattered spots of umber-brown and subdued lavender-purple. The adult is thirty inches in length; the wing, nineteen and a half inches.

WHITE-WINGED GULL (*L. leucopterus*). — This species has the same range of habitat as the preceding. It is a perfect counterpart of the same, and cannot readily be distinguished except by the size, being greatly inferior. There is also a difference in proportion. It is called by some authors the Silvery Gull (L. argentatus). Its length is twenty-four inches; wing, 16.75.

GLAUCOUS-WINGED GULL (*L. glaucescens*) has a habitat on the Pacific Coast of North America. The color is much like that of the latter. The length is twenty-seven inches; wing, 16.75.

GREAT BLACK-BACKED GULL (*L. marinus*).—Found on the Atlantic Coast, as far south as Long Island in winter, and, according to Audubon, to Florida. It is excessively shy and vigilant, and is extremely voracious, devouring all kinds of carrion, and even young birds and eggs. It will follow shoals of fishes for hours. "On the coast of Labrador," says Audubon, "I frequently saw these birds seize flounders on the edges of the shallows. They often attempted to swallow them whole, but, finding this impracticable, removed to some rock, beat them and tore them to pieces. This, or some large species, is known to drop shell-fish from a height, with the purpose of breaking the shell. While at Boston I saw one of these birds take up an eel about eighteen inches in length, and, rising with some difficulty, managed to gulp it headforemost, and fly to the neighboring shore, when a White-headed Eagle made its appearance, and soon overtook the Gull, which reluctantly gave up the eel. The Eagle seized it in his talons before it reached the water, and bore it off."

HERRING GULL (*L. argentatus*) has a habitat along the whole of the Atlantic Coast, and breeds from the Bay of Fundy to Melville Island. An English gentleman, who owned an island in the Bay of Fundy, and resided there, told Audubon that he remembered when the Gulls laid on the ground, and that the habit of building among the trees had been acquired since his sons had disturbed them in gathering the eggs. There were a few young that still built their nests on the flats. The Herring Gull has a greater range of migration than any other American species. The male is twenty-three inches in length; extent of wings, fifty-three inches.

CALIFORNIAN GULL (*L. californicus*).—Found on the Pacific Coast of North America and the interior of Arctic America, on the great lakes. Its length is twenty inches; wing, sixteen.

RING-BILLED GULL (*L. delawarensis*) is not mentioned by the earlier American authors. Its range is through the North American continent generally, throughout the interior as well as coastwise. "The Ring-billed Gull is more generally distributed throughout the interior than the Herring Gull, occurring on the larger waters of the Missouri region, and elsewhere. It migrates through the interior, up the Missouri, as well as along the coast."—*Coues.*

AMERICAN MEW GULL (*L. canus*).—Inhabits the interior of Arctic America and the Pacific Coast generally. It is not recorded as being on the Atlantic Coast.

HEERMAN'S WHITE-HEADED GULL (*L. heermani*).—Now called L. belcheri. Is abundant on the Pacific Coast. Its length is sixteen to twenty inches; wing, thirteen to fourteen.

THE COMMON KITTIWAKE (*L. tridactylus*).—This species inhabits both hemispheres in the Arctic regions, and reaches as far south in winter as the Middle States. Audubon says of it: "The Kittiwake is the most awkward of its tribe while walking, and, although it walks often on the rocks, its gait manifests a waddling *gaucherie;* but on the water, and in the air, few birds surpass it in buoyancy, grace and ease of motion. Bearing up against the heaviest gale, it passes from one trough of the sea to another, as if anxious to rest for an instant under the lee of the billows; yet, as these are seen to rear their curling crests, the Gull is seen already several feet above them, and preparing to plunge into the next hollow. While in our harbor, and during fine weather, they seem to play with their companions of other species. Now, with a spiral curve, they descend toward the water, support themselves with beats of the wing, decline their heads, and pick up a young herring or some bits of garbage, when away they fly, chased by several others anxious to rob them of the prize. Noon has arrived. High above the mast-head of our largest man-of-war the Kittiwakes float gracefully in wide circles, until all, as if fatigued, sail downward again, with common accord, towards the transparent deep, and, alighting close to each other, seem to ride safely at anchor. There they now occupy themselves in cleaning and arranging their beautiful plumage." The adult Kittiwake measures eighteen inches in length, and thirty-six inches in extent of wing.

RED-LEGGED KITTIWAKE (*L. brevirostris*).—Inhabits the North Pacific, both Asiatic and American.

IVORY GULL (*L. eberneus*).—This is a Northern species, accidental on the coast of the United States; common, in winter, in Labrador and Newfoundland. It breeds in high latitudes. The bill is bright yellow, greenish-dusky at the base; iris, brown; edges of eyelids, vermilion; feet and claws, black. The whole of the plumage is pure white. Length, to end of tail, nineteen inches; to end of wings, twenty and a half; extent of wings, forty-one.

LAUGHING GULL (*L. atricilla*).—Also called the BLACK-HEADED GULL. Inhabits the tropical and temperate parts of America, on the Atlantic side as far as Maine in summer; in the interior, to Ohio; on the Pacific, as far as California. The Laughing Gull is noted for its propensity to harass the Brown Pelican. We have witnessed this at Tortugas, where both birds are abundant. The Pelican, through having an enormous appetite, and having little skill in procuring its food, requires to fish during the larger portion of the day. Many individuals are accompanied by a Laughing Gull—never, to our knowledge, by more. The latter sits quietly on the water, awaiting events. The Pelican rises, and flaps heavily over the water, his eyes intent on the surface. If the Pelican succeeds in catching anything in his net, after diving, the Gull is sure to be near enough to alight directly on his head or back, and quickly he snatches a portion of the game for himself. The Gull readily sees the result of the fishing, for if the Pelican does not catch anything, he (the Gull) quietly drops into the water, to await events. The Pelican seems never to care for the disturbance, but goes on quietly to fish for more. A more striking example is not seen of contrast. The Pelican is the very embodiment of patience and perseverance, while the Gull is an example of the well-dressed fop who filches his living entirely by unfair means. Dr. Coues says that the White-headed Gull of California has the same habit, and he adds, they are as truly parasitic as the Jagers themselves. Audubon says: "When the breeding season has commenced, they assemble in great numbers — thousands of pairs. At this time they are so clamorous as to stun your ear with their laughing cries, though at other seasons they are generally silent, unless when suddenly aroused or when chased by the Jager." [This must be a mistake, for the Laughing Gulls at Tortugas keep up a continual *ha-ha!* during the day, the whole summer through]. "Their loves are conducted with extreme pomposity. They strut and bow to the females, throwing their heads backward, as in the case of other species. You see them stretching their heads forwards, then, with open bill, vibrating tongue, and eyes all aglowing, they emit their loud, laughing notes, which, in a general sense, resemble those of many other species, though they are not precisely similar to those of any. This bird frequently associates with the Razor-bill, and now and then they will all rise on wing, as if frightened, and perform a few contortions in the air, and again settle in the same spot, still, however, keeping separate. While thus in the company of the Razor-bills, the Gulls are with great difficulty approached, the former being exceedingly wary, and almost always rising when a person draws near, the Gulls immediately following them, and the two great flocks making off to some distant point, generally not very accessible. If taken up when wounded, they are apt to bite severely. They exhibit great sympathy for each other, endeavoring to rescue their companions when shot."

FRANKLIN'S ROSY GULL (*L. franklini*).—Found in high latitudes of North America, and only in the interior. It ranges to Mexico, the West Indies, and as far south as Chili. In North America this bird seems to be confined to the region west of the Mississippi. Length about fourteen inches; extent of wing, thirty-five.

BONAPARTE'S GULL (*L. philadelphia*).—This species has a habitat in every part of the North American continent. No one of the Gulls is so widely dispersed. Coues says: "Considering in what high latitudes it breeds, it is astonishing how early toward the fall it again appears amongst us after its brief absence. The last birds have not all left the United States in May. Some time in August

the young come straggling back, though they are not numerous until the autumn has fairly set in." "While in North Carolina I made some observations on the vernal migration of these birds that I thought interesting. There these birds are simply birds of passage, none wintering nor breeding. They appear early in April, or with the first genial weather, and may be seen through part or most of May. Then they go off, to return in September, and stay a month or so. But in spring it was a succession of birds passing, rather than the same individuals remaining so long. These birds seem to feed on insects which they catch on wing, much as the Swallows do. They also feed on shrimps and small fishes. Their flight is light, elevated and rapid, says Audubon, resembling in buoyancy that of some of our Terns, more than most of our Gulls, which move their wings more sedately. I found the adult Gulls in molts in August. Although their notes are different from those of all our other species, being shriller and more frequent, I am unable to represent them by words."

WEDGE-TAIL GULL (*Rhodostethia rosea*) inhabits the Arctic regions, but has no record in the United States. Its dimensions are : Length, fourteen inches; wing, ten and a half; tail, five and a half.

FORKED-TAIL GULL (*Xema sabinei*).—This Gull is found in the Arctic regions of both hemispheres; south in winter to the Middle States (N. Y.) and the Great Salt Lake. Its length is thirteen and three quarters inches; wing, ten and three-quarters.

SWALLOW-TAILED GULL (*Xema furcatum*).—This is found on the coast of California, and in the Arctic regions (?).

GULL-BILLED, OR MARSH TERN (*Sterna anglica*) is an inhabitant of the Eastern States, though not abundant. It is also common to Europe. Coues describes it in *Proc. Phil. Acad.*, 1862, as Gelochelidon. Its length is thirteen to fifteen inches. Extent of wing about thirty-four inches. The bill and feet are black, the former remarkably stout and obtuse.

CASPIAN TERN (*Sterna caspia*).—This is known to the Arctic regions of both continents. It reaches the Middle States in winter. It is regarded as much the largest of the Terns, being over twenty inches in length. The bill is conspicuous for its bright red color.

ROYAL TERN (*Sterna regia*).—This bird is common along the Atlantic Coast, and quite abundant farther south. It is nearly the same in length as the preceding; tail, deeply forked; bill, orange-colored.

PIKE'S TERN (*Sterna longipennis*).—Common to the Pacific Coast of North America. Mr. G. N. Lawrence described it as S. pikei, in *Ann. Lyceum Nat. Hist., N.Y.*, 1853. Its bill is black, and plumage resembles that of S. hirundo.

LEAST TERN (*Sterna superciliaris*).—Noted for its extremely small size, being only eight to nine inches long. It inhabits the United States and the coast northward. Abundant chiefly on the coast.

THE ELEGANT TERN (*Sterna galericulata*) is found in Middle and South America, up the Pacific Coast to Peru, to California and Tehuantepec, and in Brazil. It is not observed on the Atlantic Coast of the United States.

SANDWICH TERN (*Sterna cantiaca*).—This Tern is found on the Atlantic Coast to Southern New England, the Bahamas and Cuba, Jamaica, ranging into Central America, on both coasts, and south as far as Brazil. It breeds in Honduras. The wreckers say that the eggs of this species are good for food, and that the birds remain through all seasons near the breeding-places on the keys. The adult Sandwich Tern is twelve and three-quarters inches in length, and thirty-three and three-quarters in extent of wing. The bill is black, except the tip, which is yellow; inside the mouth is deep blue.

TRUDEAU'S TERN (*Sterna trudeaui*).—According to Audubon this bird is found on the Atlantic Coast of the United States, having been procured at Great Egg Harbor, New Jersey, by Mr. Trudeau, for whom it was named. It is also found in South America, as far south as Chili and Brazil. The bill is noticeably stout for its length, and especially deep at the base; the culmen is regularly curved. The outline of the rami is a little concave; that of the gonys, straight and ascending. The wing is 10.25; tail, 6.50; depth of fork, 2.75; bill along the culmen, 1.50; its depth at base, 0.38; length of gony, 1.75; tarsus, 1.70. Middle toe and claw, 1.05.

FORSTER'S TERN (*Sterna forsteri*).—This Tern is found in every part of North America. It is also found in South America, but breeds in high latitudes.

COMMON TERN (*Sterna hirundo*).—This is the most common species, and is found in Europe and North America generally, except on the Pacific side. It winters in the United States north to 57°, and passes beyond Texas. Audubon gives a cheerful account of this beautiful bird. "With an easy and buoyant flight, the Tern visits the whole of our indented coast, with the intention of procuring its food, or of rearing its young amidst all the comforts and requirements that a kind Nature has provided for it. Full of agreeable sensations, the mated pair glide along, side by side, as gayly as ever glided bridegroom and bride. The air is warm, the sky of the purest azure, and in every nook the glittering fry tempts them to satiate their appetite. Here, dancing in the sunshine, with noisy mirth, the vast congregation spreads over the sandy shores, where, from immemorial time, the species has taken up its temporary abode. They all alight, and with minced steps, and tails carefully raised, so as not to be injured by the sand, the different pairs move about, renew their caresses, and scoop out a little cavity in the soil. If you come again in a few days, you will find the place covered with eggs. There they lie, three in each hollow, beautifully spotted and pointed; and as they receive heat enough from the sun, the birds have left them until evening. But not absent are they from the cherished spot, for they have seen you, and now all fly up screaming. Although unable to drive you away, they seem most anxiously to urge your departure by every entreaty they can devise, just as you would do were your family endangered by some creature much stronger." The length of the Common Tern to the end of the tail is twelve and three-quarters inches; to the fork, eleven inches; to the

end of wings, fourteen inches; extent of wing, twenty-nine and a quarter inches.

ARCTIC TERN (*Sterna macrura*).—The habitat of this species is Europe, Asia, Africa, North America generally, south to the Middle States, and on the Pacific side to California. It breeds from Massachusetts northward. The Arctic Tern, after the winter tempests are over, is seen gliding along the coast, in company with other species. In the beginning of March, it is seen along the caves and creeks that enter into the sea. It is an extremely graceful bird, and readily attracts the attention of the most unobserving for its peculiar buoyancy, and for the rapidity with which it dives for its food. It is, however, almost invidious to compare, as the Terns are all possessed of exceeding grace and agility. At American Harbor, Nova Scotia, in June, they are to be seen in great numbers when they are breeding; no other species are seen then. Their eggs are esteemed as food, and furnish a wholesome diet to the inhabitants. Audubon says: "At the beginning of the first autumn, the plumage of the young so much resembles that of the young of Sterna hirundo that a person not paying attention to the tarsi and feet might readily confound them. Yet, even at this early age there are indications of the bluish tint on the under parts. The longest tail-feathers at this period do not extend more than two inches beyond the rest. The upper parts of the body are mottled with brown, as in all the other species, and in Gulls. The mantle of this, as in all other Terns, assumes its permanent hue before any part of the wings. The notes of this species resemble *Creek, creek!* and are often repeated when the bird is on the wing. The Terns that breed in the cooler regions sit closely on their eggs, while those of the south only incubate during the night and in rainy weather."

ROSEATE TERN (*Sterna paradisea*).—The habitat of this Tern is Europe, and that part of North America between Massachusetts and the Florida Keys; and it is also seen in the West Indies, and in Central America. It spends the breeding season along the southern shores of the Floridas in considerable numbers. We have seen it, in 1858–9, in the harbor of Tortugas, and at Key West; but since the more numerous settling of these keys, there has been a manifest falling off of visits from the various sea birds that once claimed a home there. This is at all times a noisy bird, and restless; it seems made to be continually on wing. It emits a sound, when approached during breeding season, resembling *Crāk*. Its flight is unsteady, and not unlike that of the Night Hawk, but it is buoyant and full of grace. While in search of prey it sails along or flutters over the sea with the bill downwards. When a small fish is discovered near the surface, the Tern plunges, with closed wings, and nearly disappears from sight. Like those of other species of Terns, the eggs are excellent eating. They lay the eggs to be hatched on a shallow excavation in the sand. Length $14\frac{1}{2}$; extent of wing, 30.

PORTLAND TERN (*Sterna portlandica*).—This is considered to be a new species. Mr. F. Benner procured the specimen, which Mr. Ridgway has named as above, while the U. S. Fishery Commission had its headquarters in Portland Harbor. It is numbered 64,394 in the Smithsonian Institution. Dr. Coues says of it: "It differs materially from any Tern which I have seen. * * * It apparently comes nearest dougalli, with which it is to be particularly compared." A second specimen of portlandica has been taken by Mr. William Brewster in Massachusetts. It agrees exactly, except that the black cap is more restricted, the white reaching along the middle line over the vertex to the occiput (comprising our view of the instability of this character). It is slightly larger. Wing, 10.25; tail, 6.30; culmen, 1.25; tarsus, 0.65; middle toe, *without* claw, 0.65.

ALEUTIAN TERN (*S. aleutica*).—This is one of the species new to our Avi-fauna, and, as its name implies, inhabits the Aleutian Islands. The type of the species is in the Smithsonian Institution, No. 52,517. Collected in Kodiah, June 12, 1868.

SOOTY TERN (*S. fuliginosa*) is a beautiful species, found in all parts of the warmer clime throughout the world, and is especially abundant on the Tortugas Keys, where we found it was a constant companion of the Noddy during the breeding season. It builds upon the bushes, placing a few sticks in the most careless manner across the top branches, and depositing on this rude structure a single egg. Authors speak of two and three eggs being the usual number, but in all the years we have been familiar with this bird, we have never seen more than *one* egg to a nest.

BRIDLED TERN (*S. anosthæta*).—This bird is given the same locality as the preceding. Audubon is authority for its occurrence in Florida.

BLACK TERN (*Hydrochelidon lariformis*).—Europe and North America generally are given as the localities for this species. Coues found it breeding in various parts of North-western America.

NODDY TERN (*Anous stolidus*).—This has a habitat in the South Atlantic and Gulf Coasts of North America, in the Antilles, and south to Chili and Brazil; also in Australia and the warmer portions of the world generally. The Noddy is found in Tortugas in great numbers, breeding there in May and June. Their nests are constructed very rudely upon the small shrubs called Bay Cedars.

BLACK SKIMMER (*Rhynchops nigra*).—Called also CUT-WATER. The warmer parts of America, south to 45°, is the favorite habitat of this bird. It is seldom seen above the Carolinas. On the Coast of North Carolina these birds are plentiful, where they continue until November, feeding chiefly by night or in the dusk of evening, and reposing during the day on the sand-bars. They feed somewhat in the manner of Whales, by skimming along the surface.

FAMILY—PROCELLARIIDÆ.

THE PETRELS; ALBATROSSES.

SHORT-TAILED ALBATROSS (*Diomedia brachyura*).—This is an abundant bird on the Pacific Coast. Its length is about three feet; extent of wing, seven feet. Its characteristic feature is the

extremely short tail. The adult plumage is white, with black primaries.

BLACK-FOOTED ALBATROSS (*D. nigripes*).—Has the general dimensions of the preceding, but a longer tail. The adult plumage is dark brown. It is very abundant on the Pacific Coast.

SOOTY ALBATROSS (*D. fuliginosa*).—This is about the size of the others. It is the D. fusca of Audubon.

GIANT FULMAR (*Fulmarus giganteus*) is the largest of the Petrels, being nearly as large as the Albatross. It is common off the Pacific Coast. The Fulmars are Gull-like in aspect, while the Petrels are much smaller, and are thus contrasted strikingly with the Albatrosses.

FULMAR (*F. glacialis*).—Great numbers of these birds are common to the North Atlantic Ocean. They visit the coast of the United States in winter. The Fulmar measures in length about sixteen inches. Two varieties are named: F. pacificus and F. rodgersi.

SLENDER-BILLED FULMAR (*F. tenuirostris*).—Found only on the Pacific Coast, and is of the same dimensions as the foregoing.

CAPE PIGEON; PINTADO PETREL (*Daption capensis*).—This bird is found as a straggler on the coast of California. It measures fifteen inches in length.

BLACK-CAPPED PETREL (*Æstrelata hæsitata*).—This is a casual visitor on the Atlantic Coast. Its length is sixteen inches; wing, twelve inches. It has a cuneate tail, five and a quarter inches long.

WEDGE-TAIL, OR LEAST PETREL (*Halocyptina microsoma*).—Found in Lower California. One specimen only is known. Its length is five and three-quarters inches. The tail is cuneate, two and a half inches in length. The general color of this bird is blackish, with fuliginous shade below; the greater wing coverts more grayish. The quills, tail, bill and feet are black. There is no white.

STORMY PETREL; MOTHER CAREY'S CHICKEN (*Procellaria pelagica*)—Fig. 134, vol. 1, p. 427—is of the same size, and has the coloration of the preceding species; the upper tail coverts are, however, white, with black tips. The tail is somewhat rounded. It is common on the Atlantic Coast.

LEACH'S PETREL (*Cymochorea leucorrhoa*).—Abundant on both ocean coasts. It measures eight inches long. The tail is forked, three inches long.

BLACK PETREL (*C. melania*).—Found on the coast of California. Its coloration is much the same as in the last, but has no white. It is nine inches in length; extent of wings, eighteen and a half inches.

ASHY PETREL (*C. homochroa*).—Found in California. Somewhat similar to the last, but much smaller.

FORK-TAILED PETREL (*Oceanodroma furcata*).—Common on the North Pacific Coast. Length, about eight inches; tail forked; bill black; feet dark.

HORNBY'S PETREL (*O. hornbyi*).—Found on the North-west Coast. It is very rare. No specimens are owned in this country, according to Dr. Coues. Gray described it in *Proc. Zoöl. Soc. London*, 1853, p. 62.

WILSON'S PETREL (*Oceanites oceanica*).—A very common species on our Atlantic Coast. Its length is seven to eight inches. Wilson described it as Procellaria, and Audubon as Thalassidroma wilsoni.

WHITE-BELLIED PETREL (*Fregetta grallaria*).—This is seemingly a rare bird, as it is only accidentally seen in Florida. Lawrence described it (according to Coues) in *Baird's Report*, and Bonaparte gave it the name F. lawrenci.

BLACK-TAILED SHEARWATER (*Puffinus melanurus*).—This is seen as an accidental visitor off the coast of California. It is nineteen inches in length.

CINEREOUS SHEARWATER (*P. kuhli*).—This is a not uncommon Puffin on our Atlantic Coast, yet it has until lately escaped a place in our Fauna. Its length is eighteen inches; its color, a pale brown-ash.

GREATER, OR WANDERING SHEARWATER (*P. major*) is abundant on the entire Atlantic Coast. Length, eighteen to twenty inches; its color a dark bistra-brown.

FLESH-FOOTED SHEARWATER (*P. creatopus*).—Similar to the preceding, and is regarded as a doubtful species. Its habitat is on the Pacific Coast.

MANK'S SHEARWATER (*P. anglorum*).—Common to the whole Atlantic Coast, and distinct from the other species. The general color is blackish. Length, fifteen inches; extent of wings, thirty-three.

DUSKY SHEARWATER (*P. obscurus*) is plentiful along the South Atlantic Coast, as far north as the Middle States. Its length is about twelve inches; extent of wings, twenty-six. In color it resembles the preceding, but somewhat more grayish.

BLACK-VENTED SHEARWATER (*P. opisthomelas*).—This is described by Dr. Coues, in *Proc. Phil. Acad.*, 1864. It is like the last, with some minor differences of color, etc. Habitat, Cape St. Lucas.

SOOTY SHEARWATER (*P. fuliginosus*).—Abundant on the Atlantic Coast, northward, reaching as far south as the Carolinas. It is dark sooty-brown in color. Length, eighteen inches; extent of wing, forty.

DARK-BODIED SHEARWATER (*P. amaurosoma*).—This is found at Cape St. Lucas. It is similar to the last-mentioned, with flesh-colored feet. It is regarded as a very doubtful species. Dr. Coues described it as Nectris. Length about fourteen inches.

FAMILY—COLYMBIDÆ.

THE LOONS.

LOON; GREAT NORTHERN DIVER (*Colymbus torquatus*).—This is a familiar bird in the United States and throughout the whole of North America. The present species measures two and a half to three feet in length; extent of wings, about four feet. A variety is recognized, called adamsi, or Yellow-billed Loon. Its general appearance is similar to the last, but it is larger, and has larger spots upon the back. The bill is mostly yellowish-white, four inches long.

BLACK-THROATED DIVER (*Colymbus arcticus*).—Inhabits North America and Northern Europe. Its length is less than two and a half feet; extent of wings, about three feet. The fore-neck is a purplish-black, with a patch of white streaks, the dark color ending abruptly; the bill is black. A variety, called pacificus, has the same colors, is somewhat less in size, and the bill very weak and slender. It is abundant on the North Pacific Coast in winter.

RED-THROATED DIVER (*Colymbus septentrionalis*).—This Diver is found disposed over the entire regions of Northern Europe and America. The throat is distinguished by a large chestnut-colored patch in front. The hind neck is sharply streaked with white on a blackish ground; the bill is black.

FAMILY—PODICIPIDÆ.

THE GREBES.

WESTERN GREBE (*Podiceps occidentalis*).—This Grebe is abundant on the Pacific Coast of the United States. Its length is about thirty inches; extent of wings, thirty-six. In the breeding season the adult has a short occipital crest. A variety (clarki) found in the same region is smaller, with some differences in color of plumage and in the proportions.

CRESTED GREBE (*Podiceps cristatus*).—Common throughout North America. Its length is about twenty-four inches; extent of wings, thirty-four.

RED-NECKED GREBE (*P. griseigena; var. holbölli*).—This is common in North America. Length, about eighteen inches. There is a slight ruffling of the crown feathers.

HORNED GREBE (*P. cornutus*) is abundant throughout North America. Its length is fourteen inches; extent of wings, twenty-four.

EARED GREBE (*P. auritus*).—This is common on the Pacific Coast in winter, but is mostly found in the Arctic regions. It is about the same in size and proportions as the preceding.

ST. DOMINGO GREBE (*P. dominicus*).—Found in Central America, the West Indies, Southern Colorado and Lower California. Its length is nine and a half inches. Described by Dr. Coues as Sylbeocyclus.

DAB-CHICK; PIED-BILL GREBE (*Podilymbus podiceps*).—This is not only honored with a separate generic name, but it is known by several trivial appellations, as Dipper, Diedapper, Water-witch. It is very abundant in North America. Length, twelve to fourteen inches.

FAMILY—ALCIDÆ.

THE GREAT AUK (*Alca impennis*)—Plate IX, fig. xxiii.—This bird is notable in the sense that it has ceased to exist, so far as its history is cognizant, and is noteworthy as being the expression of the lowest of its class known to the North American continent—as the Penguin of the Antarctic regions represents the lowest of all. The Northern Penguin, as the Great Auk is sometimes designated, is now so rare in collections that each individual has its history and price, or, as in some instances, is absolutely priceless. Some time not long since, a list of the existing specimens owned by institutions or persons, was published, which exhibited only sixty in number. No living specimen has been obtained for over forty years. In 1869 the large sum of $625 was paid, in London, by the American Museum of Natural History, New York, for the specimen from which our illustration is taken.. The length of the Great Auk is about three feet; its wing is only four inches long. It inhabited the highest latitudes, and was at one time abundant in the Arctic seas. The ancient shell-heaps that are so numerous along the Atlantic Coast show abundant remains of this bird, even as far south as the New England shores. Nuttall, in 1834, records this bird as then breeding in great numbers. "As a diver he is unrivalled," he says, "having almost the velocity of birds in the air. They breed in the Faroe Islands and in Iceland, Greenland and Newfoundland, nesting among the cliffs, and laying but one egg each. They are so unprolific that if this egg be destroyed, no other is laid during that season." Here, then, is a competent cause of extinction, which, in connection with great destruction of life among the adults, may well have operated to that result. "The Auk," Nuttall continues, "is known sometimes to breed in the Isle of St. Kilda; and in Papa Westra, according to Mr. Bullock, for several years past no more than a single pair had made their appearance." It is supposed that the last of this species seen alive were at the Funks, a small island off the coast of Newfoundland. In 1844, the last specimen known to be alive on the Eastern continent was seen in Iceland. In 1870 a specimen was found dead at Labrador. Though in poor condition, it was sold in England for $200. The only specimens known as being in this country are in the following institutions: American Museum of Natural History, New York; Vassar College, Philadelphia Academy, Smithsonian Institute, and Cambridge University. The egg is also preserved in several of the museums.

RAZOR-BILLED AUK (*Utamania torda*)—called also TINKER—is found abundantly on the rocky shores of the North Atlantic, coming south in winter as far as the Middle States.

PENGUIN (*Aptenodytes patagonica*)—Plate IX, fig. xxiv.—This is the lowest of the class of Birds. Its fish-like "paddles," or rudimentary wings, close scale-like plumage, and extremely terminal feet and legs, show how completely it is formed to be an exclusively aquatic creature—as much so even as the Seal, whose life and habits are quite similar. This bird is an inhabitant of the Southern hemisphere, found in the extreme Antarctic regions, and is therefore not within the group of the birds of North America. Its exceedingly interesting nature and position in the natural system, however, render it quite worthy of attention here. The name of the Penguin is derived from the term *pen-wing* or *pin-wing*. The word is extant in England at the present, and is equivalent to pinioning or "pin-winging"—to deprive of pinions. The word *pen-wing* is said to be in use in Newfoundland yet, relating to the Auk. For further account of this bird, see Vol. 1, p. 426.

HORNED PUFFIN (*Fratercula corniculata*).—This is the Mormon glacialis of Audubon. It is found on the coast of the North Pacific. Length, fourteen and a half inches.

COMMON PUFFIN; SEA PARROT (*F. arcticus*).—Abundant on the North Atlantic Coast. Length, thirteen and a half inches. A variety, glacialis, is rather larger.

TUFTED PUFFIN (*F. cirrhata*).—This is abundant on the North Pacific Coast, as far south in winter as California. It is casually seen on the Atlantic Coast. Length, fifteen to sixteen inches.

HORN-BILLED AUK (*Ceratorhina monocerata*).—Common on the Pacific Coast to California. Length, fifteen and a half inches.

PARROQUET AUK (*Phaleris psittacula*).—Found in the North Pacific. Length, nine inches.

CRESTED AUK (*Simorhynchus cristatellus*).—This is found on the North Pacific, but has not been observed on the coasts of the United States, either on the Atlantic or Pacific. Length, nine inches.

WHISKERED AUK (*S. camtschaticus*). — Habitat, North Pacific. It is similar to the preceding, but smaller, with two series of white feathers on each side of the head.

LEAST AUK (*S. pusillus*). — Called also KNOB-BILLED AUK. It is very small, being under seven inches in length. Found on the North Pacific.

ALEUTIAN AUK (*Ptychorhamphus aleuticus*).—Formerly called CASSIN'S AUK. Found on the Pacific Coast, south to Lower California. Length, nine inches.

SEA DOVE (*Mergulus alle*).—Called also DOVEKIE. Abundant on the North Atlantic Coast, and in winter is often thrown ashore along the New England Coast during heavy storms. They are not unfrequently picked up in the interior after unusually severe gales. Length, eight and a half inches.

BLACK-THROATED GUILLEMOT (*Synthliborhamphus antiquus*).—Inhabits the shores of the North Pacific.

TEMMINCK'S GUILLEMOT (*S. wurmizusume*).—This is found in abundance on the Pacific Coast to Cape St. Lucas.

MARBLED GUILLEMOT (*Brachyrhamphus marmoratus*).—Habitat, Pacific Coast to California.

KITTLITZ'S MURRELET (*B. kittlitzi*).—Habitat, North Pacific.

BLACK GUILLEMOT (*Uria grylle*).—This is familiarly called SEA PIGEON. It is very abundant on the Atlantic Coast in winter.

PIGEON GUILLEMOT (*Uria columba*). — Habitat, North Pacific.

SOOTY GUILLEMOT (*Uria carbo*).—Habitat, North Pacific.

MURRE (*Lomvia troile*) is found on both the Atlantic and Pacific Coasts, reaching as far south in winter as New Jersey and California.

THICK-BILLED GUILLEMOT (*L. arra*).—Its distribution is the same as preceding. It is called Brünnich's Guillemot (Uria brünichi) by Richardson.

FOSSIL EXTINCT BIRDS.

The Cretaceous Period, in this country, exhibits the earliest evidences of the existence of this class of vertebrates. The triassic footprints of the Connecticut Valley are pretty well established to be those of Saurians, or dinosaurian reptiles.

We avail ourselves of the valuable *Synopsis of Fossil Forms*, arranged by Dr. Coues, from the mass of new material collected by Prof. O. C. Marsh, of New Haven.

In the order *Picariæ* one new fossil and extinct genus, with one species, was found in the Lower Tertiary of Wyoming. It is about the size of a Robin, and is related to the Woodpeckers, apparently. It is named Uintornis lucaris.

Among the Raptores two genera are known—an Aquila from the Pliocene of Nebraska and a Bubo from Wyoming.

The *Gallinæ* are represented by a Wild Turkey from the Miocene of Colorado. Two other smaller species are from the Post-Pliocene of New Jersey.

The Grallatores are represented by two species of Grus; five species of an extinct genus, Aletornis; two of an extinct genus, Telmatornis, and three of an extinct genus, Palæotringa.

The Natatores have one species of Sula, rather smaller than the Gannet, from the Miocene of Carolina, a Graculus from Idaho, and an extinct genus, Graculavus, from the cretaceous greensand formation in New Jersey. Puffinus is represented by one extinct species from the Miocene of Maryland. The Guillemot has two allies in the extinct genus Catarractes, one from the Post-Pliocene of Carolina, and the other from the same formation in Maine. Laornis is an extinct genus, about the size of a Swan, from the marl of New Jersey.

In *Am. Jour. Sci. and Arts*, Vol. IV (Feb., 1872) Prof. O. C. Marsh communicated an account of certain osseous remains which were discovered in the cretaceous formations of Kansas. The remarkable bones which are thus brought to notice are those of an extinct family, and even the great difference which is seen, as compared with existing forms, entitles them to a distinct division as sub-class.

The extraordinary features which point to this latter determination are certain peculiar characters as seen in the vertebræ, the bodies being concave on each face, as in fishes. The type species of this group has well-developed teeth, also, and this is especially a feature differing widely from any other known to the class of Birds. The more important parts of the type specimen, Ichthyornis dispar, were found intact; the skull was well preserved. The size of this specimen is judged to have been about that of the Domestic Pigeon, and its structure indicates an aquatic form. The jaws of this bird (as represented in Prof. Marsh's figure) are about three inches in length. "In each lower jaw there are twenty-one distinct sockets, the series of teeth extending along the entire upper surface. The teeth are small, compressed and pointed, and all are directed more or less backwards. The crowns are covered with nearly smooth enamel. The maxillary teeth appear to have been numerous, and essentially the same as those in the mandible. Whether the premaxillary bones supported teeth, or were covered with a horny beak, cannot be determined from the present specimen. The scapular arch and bones of the wing and leg all conform closely to the true avian type." The wings are very large in proportion to the

legs, and there are several features of the posterior extremities pointing to probable aquatic habits. The concavities at each end of the vertebræ are equal and quite distinct. Its powerful wings and its formidable teeth would seem to clearly indicate a creature capable of prolonged flight, and one of a carnivorous nature. In the same geological horizon, in Kansas (1872), Prof. Marsh found another form, which he calls Apatornis celer. This is regarded as belonging to the same order as Icthyornis. The remains indicate a bird about the same size as the Icthyornis dispar, but more slender in proportions. The vertebræ are bi-concave, and teeth were probably present. The most interesting specimen discovered is the Hesperornis regalis. It is like a gigantic diver, and was discovered by Prof. Marsh in the cretaceous of Kansas, in 1870. This bird has a head much like that of the Great Diver, Colymbus. The peculiar features are a stout or prominent median crest between the orbits, small brain cavity, and the maxillaries massive, with a deep inferior groove, thickly set with sharp-pointed teeth. There are no true sockets, but imperfect projections from the sides of the grooves. "The teeth have pointed crowns, covered with enamel, and supported on stout fangs. * * * In form of crown and base they most resemble the teeth of morasauroid reptiles. * * The external appearance of the premaxillaries seems to indicate that these bones were covered with a horny bill, as in modern birds. * * The sternum is thin and weak, and entirely without a keel—resembling that of the Apteryx in front. The wings are rudimentary. The vertebræ of the cervical and dorsal regions are of the true ornithic type, the articular faces of the centra being quite as in modern birds. * * * The caudal vertebræ are very peculiar, and indicate a structure not before seen in birds. * * * The pelvic bones, although avian in type, are peculiar, and present some well-marked reptilian features. * * The acetabulum differs from that in all known birds, in being closed internally by bone, except a foramen that perforates the inner wall." The remarkable features of Hesperornis entitle it, says Prof. Marsh, to be placed in the new sub-class, *Odontornithes;* but the absence of the bi-concave vertebræ, the different setting of the teeth upon the jaw, and the absence of a keel upon the sternum, place it in a distinct order. This order is named *Odontolcæ*.

Prof. Marsh arranges the group as follows:

ODONTORNITHES.

BIRDS WITH TEETH.

An extinct group, or sub-class, known only through certain well-preserved bones, found in the cretaceous deposits of Kansas.

ODONTOTORMÆ.

Teeth contained in sockets. The vertebræ with concave faces on the body, before and behind. Sternum with a keel. The wings well developed. Two genera only are known—Icthyornis and Apatornis.

ODONTOLCÆ.

Teeth arranged in grooves. Vertebræ as in recent birds. Sternum has no keel. The wings rudimentary. Genus, Hesperornis.

In *Am. Jour. of Sci. and Arts* (June, 1876), Prof. Marsh records accounts of two additional forms from the Kansas cretaceous. They are of "gigantic size, clearly belonging to the *Hesperornithidæ*, although quite distinct from Hesperornis regalis, the type of the group." One specimen is enumerated as Lestornis crassipes, genus and species extinct. The greater part of the skeleton is preserved, and it represents a bird fully six feet in length. A second species of Hesperornis (H. gracilis) is described as being somewhat smaller than the H. regalis. Another form is a species of Icthyornis (I. victor) about one-third larger than the I. dispar.

HISTORY

OF

THE AMERICAN FAUNA.

REPTILES.

This, the third class in the descending series of the Animal Kingdom, derives its name from the Latin *reptare*, to creep, indicating one of the most characteristic features of the group. Reptiles are cold-blooded, with a heart of three chambers, containing two auricles and one ventricle; the latter being sometimes divided by a fleshy septum. The circulation is sluggish. The venous blood being in all more or less commingled with arterial, the temperature is, consequently, low. The respiration is by lungs. The Frogs and Toads—Batrachians, or Amphibians—which were once included in the class *Reptilia*, some of which breathe at one period of existence by bronchial or gill-like organs, now form a separate class. The brain of Reptiles is small, comparatively; there is no corpus callosum, but a small anterior commissure is present. The reproductive system is varied, according to the orders; the cloaca is always present. The ova in some hatch within the body, but in most they are expelled, and left to develop in the heat of the atmosphere.

The term *Herpetology* is in use to designate the study of Reptiles and Amphibians. Little attention was given to this branch of Natural History in ancient, or even later times, as compared with other classes. After a meagre attempt by Aldrovandus and Gesner, Ray recorded the first really useful knowledge on the subject. Since this, several eminent writers have made it a special study. In our country, Holbrook, Baird, and Girard and Cope have accomplished very much to bring order out of the confusion of material. Agassiz's work, *Contributions to the Nat. Hist. of the United States*, is notably a great advance, containing a vast amount of matter relating to this subject. In Europe Dr. Schreber is authority of most note. The wonderful discoveries in Palæontology have both increased the numbers of the orders and the labor of correctly defining them. The most recent authors enumerate these orders as follows—where it will be seen, by noting the italicised names, which are those of extinct orders, that an extraordinary increase of knowledge has already been realized:

Order—Crocodilia.	Order—*Plesiosaurus.*
" Lacertilia.	" *Dicynodontia.*
" Chelonia.	" *Pterosauria.*
" Ophidia.	" *Dinosauria.*
" *Ichthyosauria.*	

Order—TESTUDINATA.

The Turtles.

The term Chelonia is sometimes used to designate this order; its meaning is, simply, from the Greek, a Tortoise. The latter word is derived from *tortus*, alluding to the form of the feet or legs. The characteristic features of the Turtles are very familiar and apparent. They are bodies enclosed between two bony shields, which are more or less developed: the upper called the carapace, and the lower the plastron. The only flexible portions of the spine are those including the vertebræ of the neck and tail. The carapace—its bony part—is formed by a mingling of the dorsal and sacral vertebræ and the ribs, and a series of overlying bony plates. There are no teeth, but the jaws are sharp-edged and covered with horny sheaths. The eyes are furnished with two lids and a nictitating membrane, as in birds. Respiration is regarded as being accomplished by swallowing air. Agassiz divides the *Testudinata* into the two sub-orders, viz.: *Amydæ*, comprising the Land and Fresh-water Turtles, with retractile feet that may be used for walking; and *Chelonii*, the Sea Turtles, with flipper-like feet, chiefly used for swimming.

Family—TESTUDINIDÆ.

The Land Tortoises.

About twenty species of Land Tortoises are known. They are herbivorous, entirely confined to the land, and inhabit the warmer parts of both continents.

THE GOPHER (*Testudo carolina*).—This is genus Xerobates of Agassiz, and is the common burrowing

Tortoise of the Southern States, which bears the above designation. It is found as far north as North Carolina, in troops among the pine barrens, and lives entirely on vegetables. The flesh is esteemed a great delicacy. It measures fourteen inches in length.

FAMILY—EMYDIDÆ.

THE POND TURTLES.

Seventy or eighty species of this family are recorded, widely distributed over the world, of which a few are terrestrial.

BOX-TURTLE (*Cistudo clausa*).—This is the Cistudo carolina of Holbrook, and inhabits the United States from Maine and New York to Missouri, and southward. It is partial to dry woods. Its colors are variable, but are mostly blackish, variegated with yellowish. A variety, called the Three-toed Box Turtle (C. trinnquis), found from Pennsylvania southward, is paler in color, and has the hind feet mostly three-toed. The Box Turtle is frequently found bearing marks, dates, etc., which have been placed upon it years before its present capture. The author found one in Uxbridge, Mass., which bore the initials of a relative and a date, which were recognized as having been cut upon the back of the reptile thirty years previously. This genus has the shell curiously constructed to shut closely, hiding completely from view the extremities. It has a long list of synonyms. Locally it is the Pine Barren Terrapin, and is called by the negroes *Cooter*.

THE NORTHERN BOX-TURTLE (*C. ornata*).—This is found in Iowa and other Western States. It is described as having a flat, round and broad shell, without a keel, even when young.

WOOD TORTOISE (*Chelopus insculptus*).—Emys insculpta of Holbrook. Inhabits the States east of Ohio, in woods and fields. The shell is keeled, its plates marked with concentric striæ and radiating lines. There is a black spot upon each scale.

MUHLENBERG'S TORTOISE (*C. muhlenbergi*).—This is the Emys muhl. of Holbrook, E. biguttata of Say, and Testudo muhl. of Leconte. Its range is very limited, being found only in New Jersey and Eastern Pennsylvania, and is even there rarely seen. The length is about three and a half inches. It inhabits small brooks and streams of running water.

THE SPECKLED TORTOISE (*Nanemys guttatus*).—Emys guttata of Schneider, Testudo punctata of Daudin and Leconte. Is found in Eastern United States, and as far west as Northern Indiana. It is an abundant species. The main color is black, spotted with orange. The plastron is yellow, blotched with black.

BLANDING'S TORTOISE (*Emys meleagris*).—C. blandingi of Holbrook. Found in Wisconsin, and eastward to the Alleghanies, in moist woods and fields. It is jet-black, having usually yellow spots. The plastron is yellowish, with quadrangular blotches of black. There are no keels upon the shell.

THE PAINTED TURTLE (*Chrysemys picta*).—Emys picta of Schneider, Testudo picta of Leconte; familiarly known as the MUD TURTLE, and one of the most common Turtles of the Northern States, as far east as New England. It is greenish-black, the plates having paler margin. The marginal plates are marked with bright red. The plastron is yellow, sometimes blotched with brown. Length of shell, six and a half inches. A variety, C. marginata, has the plates of the carapace in quincunx. It is found in Western New York, and westward. C. oregonensis is found in Minnesota and westward, and has no red markings.

MAP TURTLE (*Malacoclemmys geographicus*).—Emys geographica of Leseur. This is one of the group called Marsh Turtles. Its curious markings are suggestive of the lines of a map; hence the name. It is found in the Mississippi Valley, and north-eastward to New York.

LESEUR'S MAP TURTLE (*M. pseudo-geographicus*).—Has a habitat in Wisconsin to Ohio, and southwest. It is much like the preceding, but grayer; the markings are paler and in larger pattern.

SALT-MARSH TURTLE (*M. palustris*).—Called, also, DIAMOND-BACK; and Testudo palustris by Leconte. The colors are greenish or olive, of dark shade; with concentric dark stripes along the plates of both shells. Its habitat is from New York to Texas, along the coast. "It is found along the northern shores of Long Island, where it is called Salt-water Terrapin, and is the justly prized and well-known Terrapin of epicures. They are found exclusively in salt or brackish streams near the sea shore. They bury themselves in the mud during the winter, from which they are taken in great numbers, and are then very fat."—*DeKay*.

SMOOTH TERRAPIN (*Emys terrapin*).—This species is found placed in DeKay's *Nat. Hist. New York Zoölogy*, 1842, with the above-named nomenclature. Its synonyms are recorded as follows: Testudo terrapin, Schæpff; Emys concentrica, Gray; and Emys terrapin, Holbrook. Dr. DeKay remarks: "Both this and the preceding (M. palustris) are brought to our markets at the same time, and sold under the name of 'Terrapin.' The market people say that they are caught in the same localities. I am inclined to think that the latter inhabits indifferently salt and fresh water."

RED-BELLIED TERRAPIN (*Pseudemys rugosa*)—Emys rubriventris of Leconte; E. serrata of Say, Harlan and Gray. This species is common to the Middle States, from New Jersey to Virginia. It is a handsome creature, and easily distinguished by its serrated jaws. As an edible it is prized considerably. Length of shell, eleven inches.

HIEROGLYPHIC TURTLE (*P. hieroglyphica*).—Emys hiero., Holbrook. Inhabits the Eastern United States. The shell is smooth, flat, and olive-brown in color, with broad, reticulated, yellowish lines; the lower shell is pale yellow. The head is very small. Length of shell, twelve inches.

YELLOW-BELLIED TERRAPIN (*P. troosti*).—Emys holbrooki. Found in the Valley of the Mississippi, and northward to Illinois. Its colors are greenish-black; the side plates having horn-colored lines and spots; the under shell or plastron dull

yellow, with large black blotches. The throat is striped with greenish. Length of shell, eight inches.

ELEGANT TERRAPIN (*P. elegans*).—Ranges from the Rocky Mountains eastward to Illinois. The colors are brown, with yellowish heavy lines and blotches; a band, blood in color, on each side of the neck. The plastron is yellow, with a dusky blotch on each plate.

ROUGH TERRAPIN (*P. scabra*).—Emys insculpta of Leconte. Is found along the shore from Virginia to Florida. It is dark brown, with yellow stripes. The plastron is yellow, with small black blotches in front. Length of shell, eight inches.

The following species are recorded by DeKay :—*Emys floridana:* length of shell, fifteen inches ; color brown, with numerous dashes of dusky. Inhabits Florida. *E. reticulata:* length of shell, nine inches ; color, dark brown, with yellow lines, and a yellow dorsal line ; neck very long ; feet striped with yellow. Carolina and Georgia. *E. serrata:* length, twelve inches. Virginia and Georgia. *E. concinna:* length, eight inches. Georgia and Carolina. *E. mobilensis:* shell, fifteen inches. Alabama. *E. oregonensis:* length, eight inches. Columbia River. *E. megacephla:* length, eight inches. Tennessee. *E. cumberlandensis:* length, eight inches. Tennessee.

FAMILY—CINOSTERNIDÆ.

THE CINOSTERNOID TURTLES.

SMALL MUD-TURTLE (*Cinosternum pennsylvanicum*).—Found in New York, and southward to Florida. The family and generic term indicates a movable sternum. The shell is a dusky-brown ; the head and neck with light stripes and yellow dots. It is the Thrynosternum of Agassiz, and is called in some localities SMALL BOX TURTLE. It abounds in muddy pools, living on fish. Length of shell, three and a half inches.

MUSK-TURTLE (*Aromochelys odoratus*).—Sternothacrus of Bell, Ozotheca of Agassiz. This is abundant in the Eastern United States, westward to Indiana. It is distinguished by its exceedingly potent, musky odor. Length of shell, three and a half inches.

LITTLE MUSK-TURTLE (*A. carniatus*).—Goniochelys minor, of Agassiz. Found in the Mississippi region.

FAMILY—CHELYDRIDÆ.

THE SNAPPING TURTLES.

This includes large and strong Turtles, that are mostly aquatic in habit.

COMMON SNAPPING-TURTLE (*Chelydra serpentina*).—This is a familiar form, and abundant in all parts of America north of Ecuador, generally in stagnant pools. It is extremely voracious, and feeds upon fish or any animal food that comes in its way. Notwithstanding this habit, the flesh is regarded as a delicacy. When caught there is always given out an odor of musk. Dr. Pickering records one as measuring over four feet in length. The shell is but about half this in length.

MISSISSIPPI SNAPPER (*Macrochelys lacertina*).—Gypochelys of Agassiz. This is one of the forms called Alligator Snapper. It is common in the Gulf States, and north as far as Illinois. This species is regarded as the strongest and most ferocious of reptiles.

Holbrook records a Tortoise under the name of TEMMINCK'S SNAPPER (*Chelonura temminck.*)

FAMILY—TRIONYCHIDÆ.

The family name indicates a three-toed race. The species are called Soft-shelled Turtles.

COMMON SOFT-SHELLED TURTLE (*Aspidonectes spinifer*).—This is the Trionyx ferox of numerous authors, and is abundant in the Mississippi River and the great lakes.

CUMBERLAND TURTLE (*A. nuchalis*).—Inhabits the Cumberland and Upper Tennessee Rivers. The carapace is ornamented with very large spines and tubercles.

LEATHERY TURTLE (*Amyda mutica*).—The habitat of this Turtle is the same as the preceding. It differs, however, in having no spines or tubercles. It is Trionyx muticus of Leconte, Gray and Harlan and Symnopus muticus of Dumeril and Bibron.

FAMILY—CHELONIDÆ.

THE SEA TURTLES.

Wallace, in *Geographical Dist. Animals*, presents this family as embracing two genera and five species, which are generally distributed throughout the warmer seas. Holbrook, in *N. A. Herpetology*, 1842, places the Sea Turtles in family *Thallasites* of Dumeril and Bibron, and includes genera Chelonia and Sphargis. DeKay records all our American Turtles under one family—the *Chelonidæ.*

THE GREEN TURTLE (*Chelonia mydas*).—Chelone viridis of Wallace. This is a particularly well-known reptile, as its commercial importance is such as to bring it constantly in view during the colder season. The waters around the islands or Keys of the Florida Reef abound in them, where a considerable number of men are employed to supply the Key West market. At the latter place the reptiles are confined in cages built in the shallow water, whence a steady supply is kept up for the New York and Baltimore markets by weekly steamers. We have seen the young of this Turtle in great numbers in the channels among the remote portions of the sounds and inlets of Southern Florida. In several instances it has been captured off Coney Island at the mouth of New York harbor. Fine specimens are kept alive in the New York Aquarium, where the creatures show their peculiar habits ; the manner of swimming, much like the flight of a bird, being an interesting exhibition. The Green Turtle is regarded as the best edible among the Chelonians. Its flavor is said to be enhanced by feeding on the tender algæ (Zostera marina) of the shallow waters of the Reef. According to Agassiz, only two well-marked species of Chelonia, the present genus, are known, the second

being the Mottled Turtle of the Pacific (Chelonia virgata). The C. mydas is more abundant about Ascension Island, and is very common on the Bahamas and the West Indies. At Cayman's Island large numbers breed. Agassiz treats of the Green Turtle, which is found on the coast of California, as "entirely distinct from that of the Atlantic, by its more elevated and more arched back, and by the emargination of its sides over the hind limbs. * * * I am inclined to admit that my California specimens are identical with C. maculosa; but I question the specific difference of C. maculosa (*Cuvier*), and C. virgata, (*Schw.*), and therefore refer them under the older name, Chelonia virgata." Audubon gives some interesting details concerning the habits of the Green Turtle at Tortugas; describes the manner of depositing their eggs, etc., but during eight years' residence at Tortugas, from 1859, we know of only one instance of the capture of a Green Turtle on this group of islands, and this is the only instance of an attempt to lay their eggs there. The occupation of the islands by man seems to have entirely checked their old habit. Dr. Strobel informed Dr. Holbrook that Green Turtles caught at the Tortugas Islands were marked and taken to Key West, and there they escaped from confinement, and reappeared to lay their eggs on the same islands in the Tortugas group. For an account of the habits of the large Sea Turtles, see the Loggerhead Tortoise.

THE LOGGERHEAD (*Chelonia caretta*).—This is placed in another genus by Agassiz—Thalassochelys caouana. It has a much wider range than the Green Turtle. Holbrook says: "It frequently lays its eggs on the sandy shoals of Georgia, Carolina and Virginia," and "it is much more shy and wary in its habits than the Green Turtle." DeKay records this species as Hawksbill Turtle. It is common on the European Coast, and is thought to be identical with the Mediterranean species. Audubon states that it feeds upon the large conch shells. The notable feature of the Loggerhead is its enormous head and neck. The length of this creature reaches about four feet, and its weight from three hundred to four hundred pounds. Holbrook says, "sometimes weighing sixteen hundred pounds." The flesh is eaten by the residents of the reef, when beef is scarce, and Green Turtles prove too expensive. The members of the garrison at Fort Jefferson make good use of its flesh, and the commissary, during the season, regularly serve it as fresh meat, quite to the satisfaction of the troops, who enjoy it as a soup, as well as in the form of steaks. The eggs are also prized; they are tolerably good, cooked in omelet, or in cake. About the last of April the Loggerhead is seen cautiously peering toward land, in the vicinity of the islands where it has bred. Only on moonlight nights does it venture ashore. It creeps slowly upwards, furtively casting about, and ready to turn seaward at once, if interrupted; but once fairly at the work, nothing turns it. It is not an uncommon thing for "Turtlers" to go boldly forward, *after* the creature has commenced to lay, and, while they sit on its back, take the eggs as they are dropped and transfer them to their own receptacle, when the poor deluded reptile patiently and stupidly proceeds to cover what she fondly regards as her precious charge, now only the empty hole. The digging and covering is all done by the hind flippers.

HAWKBILL TURTLE (*Chelonia imbricata, Linn.*)—This is Eretmochelys imbricata, Fitz., recorded as such by Agassiz, and is known as Testudo imbricata and Caretta imbricata. It is common in the West Indies, and extends all through the Gulf of Mexico, and along the southern coast of the United States. On the Florida Reef we have met with small specimens; these were particularly regarded as excellent food, very tender and of good flavor. The habits are much the same as those of other Sea Turtles. Its food is mostly flesh of large conchs and other marine animals. It is seemingly very ferocious, its sharp bill giving it extraordinary power. When confined with other species, it often attacks them, and inflicts severe wounds with little or no provocation. The shell of this species is highly prized for its uses in jewelry and the comb manufacture. The Green Turtle is said to furnish the common kinds of commerce. A species of this genus, E. squamata, is found in the Indian and Pacific Oceans.

THE LEATHER TORTOISE (*Sphargis coriacea*).—This enormous creature, by far the most bulky of living Turtles, is generally distributed throughout the world, though some authors have expressed a doubt that those found in widely separated seas are identical. Agassiz says: "In my opinion it is not yet clearly proved that the specimens observed in these different stations truly belong to one species." This Turtle was first seen and described by Rondelet in 1554, and was from the Mediterranean Sea. It has since been occasionally seen, and quite recently it appears to have very materially increased in numbers, or it has become more familiar through more numerous captures. In 1824 a specimen was taken in Massachusetts Bay. At that time none had been known on our coast, and it proved not only a rare reptile to the public, but equally so to naturalists. It was purchased at a large sum, and is now in the Boston Museum. This specimen measures eight feet and one inch in length, and occupies an entire case. We have seen one fresh specimen, which drifted ashore at Nahant Beach; a bullet hole in the neck, and one through the shell, seemed to indicate its probable fate. This specimen was but three feet and a half in length, and, like others that we have examined, was quite black in color. Holbrook figures one as brown, which, he says, was colored from life. The Leather Tortoise is quite distinctive in shape and ornamentation. Its upper shell is composed of six longitudinal plates, which join each other in raised ridges, somewhat serrated. It is truly an oceanic species.

ORDER—LACERTILIA.

THE LIZARDS.

THIS order embraces those Reptiles that have an elongated body, with four limbs, and no shields, the body being usually covered with overlapping scales. The larger number are found in the warmer region.

FAMILY—IGUANIDÆ.

There are about sixty genera and one hundred and fifty species of this family, all found in South America and the Antilles. According to Holbrook four genera of this family are found in the United States.

PINE-TREE LIZARD (*Sceloporus undulatus*).—Called, also, the SWIFT, and BROWN SWIFT (Tropidolepis). An abundant and beautiful creature, in the Southern States.

HORNED TOAD (*Phrynosoma douglassi*).—Called, also, TEGUEXIN. Found in Central America, and in western portions of the United States. Holbrook records three other species. They inhabit the region south of the Columbia River. The same author records the following species additional under the family *Iguanidæ*.

GREEN LIZARD, OR CHAMELEON (*Anolius carolinensis*).—This is an attractive creature, of graceful shape and movements, and is handsome green in color. Habitat along the Atlantic States to the Gulf of Mexico. Length six to eight inches.

FAMILY—ANGUIDÆ.

THE GLASS SNAKES.

In this family there are limbs rudimentary and hidden under the skin. The internal structure is that of the Lizards, but having a Snake-like form.

GLASS SNAKE (*Ophisaurus ventralis.*)—This is eminently a serpentiform creature. There are no external limbs. The tail is very brittle, and the animal has from that fact been regarded as so fragile that a sharp blow will "fracture" the body. The truth is, there is a thin transverse septum between the vertebræ, and this is the point where separation so readily takes place. It inhabits Tennessee to Kansas, and southward.

FAMILY—TEIDÆ.

THE TEGUEXINS.

This family derives its name from some local designation. The species are all of the New World. There are twelve genera and about forty species.

THE SIX-LINED LIZARD (*Cnemidophorus sexlineatus*).—Called, in the South, TARAQUIRA. It inhabits the States from Virginia to Mexico. This is Amicra of Linnæus.

FAMILY—SCINCIDÆ.

THE SKINKS.

Fifty genera and one hundred and fifty species of this family are known, distributed throughout various parts of the world. The term Skink is from the Greek, merely meaning some kind of Lizard.

BLUE-TAILED LIZARD (*Eumeces fasciatus*).—Very abundant in the Southern States, east of the Rocky Mountains. It is black, with fine yellow streaks, the middle one forked on the head. The tail is mostly blue.

NORTHERN SKINK (*E. septentrionalis*).—Found in Minnesota and Nebraska.

COAL SKINK (*E. anthracinus*).—Inhabits the Alleghanies, from Pennsylvania southward.

GROUND LIZARD; MOCOS (*Oligosoma laterale*).—Lygosoma lateralis, Linn; Scincus unicolor, Har. The generic name indicates small body. It is abundant in the Southern States, and north to Illinois.

RED-HEADED SKINK (*Plestiodon erythrocephalus*).—DeKay records this as inhabiting Pennsylvania to Florida. Length, twelve inches. Holbrook gives the common name in the south as Scorpion. Two other species of Scincus are recorded by Holbrook—S. quinquelineatus and S. fasciatus, both exceedingly pretty objects, inhabiting the Gulf States. The latter is a synonym of the Blue-tailed Lizard (Eumeces fasciatus).

ORDER—OPHIDIA.

THE SERPENTS.

THE Serpents, which are embraced in this order, areReptiles with an external covering of imbricated scales, but with no shields. The bones of the jaws are so connected by ligaments that an enormous dilatability is possible. There are no limbs, but very rudimentary appendages are in some species visible near the vent. The remarkable elongation of form, and absence of limbs, constitute the most distinctive features. We have followed the catalogue of Baird and Girard (*North Am. Reptiles in the Smithsonian Institution, Part I, Serpents*) for an enumeration of *Ophidia*.

FAMILY—CROTALIDÆ.

The Rattlesnakes are included in this group. The term Crotalus is from the Greek, meaning "rattle," referring here to the remarkable feature which characterizes most of the members of this family. These Serpents have no solid teeth, but there are two erectile, grooved poison fangs on the upper jaw. A dis-

tinctive feature is the deep pit in the head, just before the eyes. The genera Aghistrodon and Toxicophis are not provided with the rattles.

THE NORTHERN RATTLESNAKE (*Crotalus durissus*).—Called, also, the BANDED RATTLESNAKE. This well-known and dreaded creature is found in rocky places, as far north as upper portions of New England and New York State, west as far as the foot of the Rocky Mountains, and southward to the Gulf of Mexico. Along the shores of Lake Champlain they are particularly abundant. DeKay records an item, taken from a local newspaper, as follows: "Two men in three days killed eleven hundred and four Rattlesnakes on the east side of Tongue Mountain, in the town of Bolton, N. Y." The remarkable development of the tail, which is in effect a powerful rattle, is quite unique in the history of Reptiles. When suddenly disturbed, this creature throws itself into a coil, and the series of horny plates commence to vibrate with great rapidity; the Snake all the while ready to retreat, rather than attack, but yet, when approached, on the alert to strike its deadly fangs into whatever comes within its reach. The popular belief that a rattle is added every year is untrue. Dr. Holbrook says: "I have known two rattles added in one year, and Dr. Bachmann has observed four produced in the same length of time." Mr. Peale, of the Philadelphia Museum, kept a female Rattlesnake fourteen years. It had when he first arrived eleven rattles. Several were lost annually, and new ones took their place. At its death, after fourteen years confinement, there were still but eleven joints, although it had increased four inches in length. Holbrook says: "The greatest number of rattles I have seen is twenty-one, all of which were perfect." The *Columbian Magazine*, 1786, gives an account of a Rattlesnake which had the unprecedented number of forty-four rattles. An opportunity is offered to study the more interesting of our American Snakes at the New York Aquarium, and there witness the exhibition of the peculiar habits of the Rattlesnake. A slight touch of the creature will serve to put him on guard, and his rattle into motion. The pretended "charming powers" of this Snake are not recognized by naturalists.

THE DIAMOND RATTLESNAKE (*C. horridus*).—C. adamanteus, Beauv.; C. rhombifer, Latreille and others. This is strictly a southern species, being confined to the Atlantic seaboard below the Carolinas. It inhabits damp and shady places, keeping near the water, hence it is called "Water-rattle." It is the largest of its genus, measuring, in some instances, eight feet in length. The Crotalus atrox is described by Baird and Girard as a Texan species. Another is from Oregon, and is named C. lucifer. From the Red River, in Texas, a species is taken, which is named C. confluentus, Say, and C. leconti. C. molossus is found in New Mexico.

GROUND RATTLESNAKE (*Crotalophorus miliarius*).—This is called by Holbrook the SMALL RATTLESNAKE. It is about thirteen inches in length. Its habitat ranges from Carolinas to the Gulf States. This is said to be very venomous, but its small size renders it less to be dreaded. Other species are C. consors, Texas; C. tergeminus, the Prairie Rattlesnake; C. edwardsi, Texas; and C. kirtlandi, Ohio.

THE COPPERHEAD (*Agkistrodon contortrix*).—Trogonocephalus of Holbrook. This is the dreaded COTTON-MOUTH of the Southern negroes. Its range is from the Catskill Mountains southward to the Gulf States. Its color is a hazel-brown, with a bright coppery hue upon its head. The length is about two feet. DeKay says the Copperhead is a vicious reptile, and its bite is justly dreaded. Its poison is considered as deadly as that of the Rattlesnake. It is called the Dumb Rattlesnake, Red Adder, Red Viper, Deaf Adder and Chunkhead, and is a sluggish creature, found mostly in low meadow grounds and pastures, feeding on mice, frogs, etc.

THE WATER MOCCASIN (*Toxitophis piscivorus*).—Called WATERVIPER. Trogonocephalus of Holbrook. The range of this reptile is from the Pedee River, North Carolina to the Gulf States, and to a certain extent along the Mississippi River. While the Rattlesnakes, and many others which do not readily or habitually take to the water, feed upon the land, this Snake is emphatically an aquatic one. He pursues the fishes of small streams, and the small reptiles that live in such localities. Cuvier's T. tisiphone is thought to be the same. The Water Moccasin is the most dreaded of all noxious reptiles in our country. The Southern negroes regard it with especial terror, as they are much exposed in their work in the rice swamps. The reptile readily attacks anything, human or brute; in this respect it is quite different from the Rattlesnake, which shrinks from everything save the small creatures that constitute its legitimate prey. The length given by Holbrook is nineteen inches. It is very stout in proportion to its length. Baird and Girard record a species, T. pugnax, from Indianola, Texas.

FAMILY—COLUBRIDÆ.

This is a very large family, numbering nearly one hundred genera, and nearly four hundred species.

BEAD SNAKE (*Elaps fulvius, Cuv.*)—Called, also, HARLEQUIN SNAKE. Inhabits Virginia, and southward to Arkansas. It is a very beautiful Snake, and though possessing poison fangs, is yet very gentle and mild in disposition. It is jet black, with seventeen broad crimson rings, each bordered with yellow. Two other species are recorded, E. tenere and E. tristis. Habitat, Texas.

RIBBAND SNAKE (*Eutainia saurita, B. and G.*)—Called, also, SWIFT GARTER SNAKE. The generic term indicates the ribbon-like character of the markings. Inhabits east of the Alleghanies, and south to Georgia.

FAIRIES' GARTER SNAKE (*E. faireyi, B. and G.*)—Found in the Mississippi Valley, northward to Wisconsin.

SAY'S GARTER SNAKE (*E. proxima, B. and G.*)—Habitat same as preceding.

HAY'S GARTER SNAKE (*E. radix, B. and G.*)—Habitat, Lake Michigan to Oregon.

COMMON GARTER SNAKE (*E. sirtalis, B. and G.*)—This is the familiar Striped Snake of the Northeastern States, and is our most common species. Several varieties are known. Ten other species are enumerated in the United States.

WATER ADDER (*Nerodia sipedon, B. and G.*)—Tropidonotus, *Holb.* This is an exceedingly common aquatic Snake, indigenous to the Eastern United States. A variety, called the Red-bellied Water Snake, is known in Michigan. Four other species are known. Regina has four species in the Southern States: R. clarki, R. grahami, R. rigida and R. leberis. Ninia diademata is a Mexican form.

THE BLOWING VIPER (*Heterodon platyrhinos, Latr.*)—HOG-NOSE SNAKE. This is abundant in some parts of the Eastern States. It is a vicious-appearing creature, but harmless. H. simus is found in the Western States. Five other species are known in this country.

THE PINE SNAKE (*Pituophis melanoleucus, Holb.*)—Called, also, BULL SNAKE. Found in the pine woods, from New Jersey to the Gulf States. The term of the genus implies the pine-wood habit. Another species, P. sayi, is found in Wisconsin. Five others are recorded.

ALLEGHANY BLACK SNAKE (*Scotophis alleghaniensis, B. and G.*)—Coluber of Holbrook. We apply a trivial name to this species. It was first discovered on the summit of the Blue Ridge, in Virginia, by Mr. Geo. Robbins, of Philadelphia. Specimens are found among the highlands of the Hudson, New York. It resembles the Common Black Snake, but has carinated scales. Holbrook's specimen measures five feet three inches. It is credited with an "exceedingly mild and gentle disposition, quite in contrast with the Black Snake (C. constrictor)."—*Holbrook.* DeKay names this species the Pilot Black Snake, and in some localities it is called Racer.

FOX SNAKE (*S. vulpinus, B. and G.*)—Inhabits from Massachusetts to Kansas, and northward.

SPOTTED RACER (*S. guttatus, B. and G.*)—Coluber guttatus, Holbrook. This is the familiar CORN SNAKE of the South. Its northern limit is the Carolinas, or Virginia.

CHICKEN SNAKE (*S. quadrivittatus, B. and G.*)—This is found in Florida, first by Bartram, and afterwards described by Prof. Agassiz. It reaches north as far as North Carolina. It is about three feet six inches in length. Other species of Scotophis, recorded by Baird and Girard, are S. lindheimeri, Texas; S. confinis, South Carolina; and S. lactus, Arkansas.

CHAIN SNAKE (*Ophibolus getulus, B. and G.*)—Called THUNDER SNAKE and KING SNAKE. Found abundantly in wet places in the Southern States. It is one of the most beautiful of the order, both in color and pattern of figure. It is said to be found as far north as Maryland.

SAY'S SNAKE (*O. sayi, B. and G.*) is a most attractive creature, having a bluish-black body, with round milk-white spots, thickly bespattered over its entire upper surface. It measures from three to four feet in length, and is found in the Gulf States.

RED SNAKE; CORN SNAKE (*O. doliatus, B. and G.*)—This is a small, but elegant reptile, measuring eleven inches in length. It is the Coronella doliata of Holbrook. The body is a brilliant scarlet in color, with many jet-black rings, a white ring between each pair of black. Its habitat is from the Middle States southward.

HOUSE SNAKE; MILK SNAKE (*O. clericus, B. and G.*)—Coluber eximius of Holbrook; Coronella of DeKay. Called Milk Snake, from the fact that it frequents dairies or cellars where milk is kept. It is a harmless and familiar creature. Its habitat is the Middle States, and north as far as Maine. In Massachusetts it is called Chequered Adder, and in New York State, Sand King and Sachem Snake. Baird and Girard record other species, as O. gentilis, Arkansas; O. rhombo-maculatus, Georgia.

KENNICUT'S CHAIN SNAKE (*O. calligaster* (*Say*) *Cope*).—O. evansi, Kennicutt. Found from Illinois to Kansas.

INDIGO SNAKE (*Georgia couperi, B. and G.*)—Called, also, GOPHER SNAKE. This is a dark blue, and much resembles the Black Snake in color, but is very much stouter in body. It is a harmless Snake, and, being stout and courageous, it has the reputation among the negroes of killing the Rattlesnake. It frequents the holes of the Gopher.

THE BLACK SNAKE (*Bascanion constrictor, B. and G.*)—Coluber constrictor of authors. This familiar serpent of our country-side is the beau ideal of the race, expressing the most slender and graceful form, with an extreme length of body. The tail is prolonged gradually to a mere point, and becomes highly prehensile. The head is graceful, and the steel-bluish uniform color, with the beautifully tessellated arrangement of scales, all tend to render the creature exceedingly attractive. Added to this, the Black Snake is the most active and powerful of the order, and is wild and untameable. We have witnessed a combat between a Black Snake and a Rattlesnake, in which the former quickly defeated its adversary, by coiling around its body and crushing it, and thus forcing it to disgorge the prey which was in dispute. This species is widely distributed over the United States. Baird and Girard dedicated a new species to J. C. Fremont, calling it B. fremonti. It has a stouter body than the preceding, and the head is larger. Habitat, California. B. foxi, Pennsylvania; B. flaviventris, California; and B. vetustus, Oregon, are enumerated.

COACH-WHIP SNAKE (*Masticophis flagelliformis, B. and G.*)—This is a rare form, found in Georgia and the Gulf States. It is a very long and graceful Snake, and a rapid runner. M. flavigularis is from Texas. M. mormon is a species found in the valley of the Great Salt Lake. M. ornatus, Texas; and M. taeniatus, California. Salvadora of Baird and Girard has a species, S. grahami, found in Mexico.

GREEN SNAKE (*Leptophis æstivus, Holb.*)—This is a most graceful and beautiful creature, being nearly the same in shape as the Black Snake, but much smaller, and of a brilliant green color. Found in Southern States. L. majalis is from Texas and Arkansas.

COMMON GREEN SNAKE (*Chlorosoma vernalis, B. and G.*)—Called GRASS SNAKE in the Northern States. It inhabits from Massachusetts to Pennsylvania. Contia is a genus of Baird and Girard, containing one species, C. mitis, California.

RING-NECK SNAKE (*Diadophis punctatus, B. and G.*)—Called, also, the LITTLE BLACK AND RED SNAKE. Habitat, from Maine to Florida. D. amabilis is found in California; D. docilis, Texas; D. pulchellus, California; D. regalis, Mexico. Lodia tenuis, B. and G., is a form inhabiting Puget's Sound. It is Calamaria tenuis of B. and G. Sonora semiannulata, B. and G., is a genus found in Mexico.

THE SCARLET SNAKE (*Rhinostoma coccinea, B. and G., Holb.*) is an exceedingly richly colored Snake, inhabiting the Gulf States. Rhinocheilus lecontei is a species found by Leconte in San Diego, California.

BROWN SNAKE (*Haldea striatula, B. and G.*)—Habitat, Virginia to South Carolina and Gulf States.

HORN SNAKE (*Farancia abacurus, B. and G.*)—Coluber, Holbrook. Called also RED-BELLIED SNAKE. Habitat, Gulf States. Abastor erythrogrammus, Gray, is found in the Gulf States. Virginia valeriæ, B. and G. Habitat, Southern States.

WORM SNAKE (*Celuta amœna, B. and G.*)—Called, also, GROUND SNAKE. Habitat, from Pennsylvania to Gulf States. Tantilla embraces two species, coronata and gracilis. Southern States.

THE ELAPSOID OSCEOLA (*Osceola elapsoidea, B. and G.*) is a remarkably beautiful little creature, being a bright scarlet in color, with rings of jet black, divided with rings of white. It is hardly more than six inches in length. Habitat, Southern States.

SMALL BROWN SNAKE (*Storeria dekayi, B. and G.*)—This is Tropidonotus of Holbrook, a small gray-colored form, with minute spots of black along its upper parts. Another species is the S. occipito maculata, which is found from New York to the Gulf States.

FAMILY—BOIDÆ.

The characteristics of this family are seen in the presence of rudiments of hinder limbs, or spur-like appendages, situated near the anus. Both jaws are provided with teeth. Two genera are known in North America: Wenona and Charina. The former is distinguished by its small head, which is conical and slightly swollen on the temporal region, though not separated from the body by a contracted neck. The snout protrudes beyond the lower jaw. There are numerous small scales or shields on the temporal region. The tail is rather short, stout and blunt.

LEAD-COLORED WENONA (*Wenona plumbea, B. and G.*)—Inhabits Puget's Sound. Wenona isabella, another species, is found in the same region. The genus Charina has one species, which much resembles the preceding.

FAMILY—TYPHLOPIDÆ.

The characters of this family are: Teeth only in one jaw, either the upper or lower; the upper jaw strongly projecting; scales on the belly instead of scutellæ, disposed in several series like those on the upper surface. Two genera are known to North America: Rena and Opthalmidion.

ORDER—CROCODILIA.

THIS order is composed of forms which are arranged in two families, the Crocodiles and Alligators. The shape of the head is the most apparent distinctive mark between the two, the muzzle of the former being much narrower behind the nostrils. That of the Alligator forms a straight line. Other anatomical differences are noticed. The Gavial, or Crocodile of the Ganges, is an enormous creature, sometimes reaching thirty feet in length. The Crocodile of the Nile is also a formidable example.

FAMILY—CROCODILIDÆ.

THE AMERICAN CROCODILE (*Crocodilus acutus*).—C. americanus of some authors. This reptile is common in the waters of the West Indies, and within a few years has been found inhabiting the bays or inlets in Southern Florida. A specimen procured from the latter locality, measuring fourteen feet in length, is in the Smithsonian Institution. A distinguishing feature of the Crocodile is the fitting of the lower canine-teeth into a notch in the edge of the upper jaw. The muzzle is strikingly narrow, as compared with that of the Alligator. The toes are also webbed to the tip.

FAMILY—ALLIGATORIDÆ.

THE ALLIGATOR (*Alligator mississippiensis*)—Plate 8, fig. 7.—A familiar reptile in the warmer parts of America. The term Alligator is a corruption of the Spanish *el lagarto*, a Lizard. This species is especially abundant in the fresh-water streams of Florida. It is usually seen about six or seven feet in length; occasionally twice that length is attained. A fine specimen in the American Museum at Central Park, New York, is twelve feet in length. The term Caiman is used to distinguish this species in some places, and also Pike-muzzled Cayman. Holbrook records one as thirteen and a half feet in length. The Alligator is extremely voracious in its native state, and feeds on all animal food that it can reach, not hesitating to attack man or beast. The term Jacare is applied to forms found in the South American waters and in the West Indies. Five species are known. The especial characteristic of this genus is a prominent ridge across the face in front of the eyes. These creatures all construct sand hillocks, wherein to deposit their eggs, the sun hatching them in about thirty days.

ORDER—AMPHISBÆNIA (*Double Walkers*).

This order embraces a few forms, the typical one being named from the fact that it is supposed to progress in either direction equally well. A description of the order will be found in Vol. II., pp. 84–5.

CLASS—BATRACHIA (*Batrachians*).

ANIMALS of this class are cold-blooded vertebrates, closely allied to the Fishes, having external gills or branchiæ, but no rayed fins. On the other hand, their well-developed limbs show close alliance with the Reptiles. The Batrachians undergo a more or less perfect change from the Tadpole, aquatic and fish-like, breathing by means of external gills, to the perfect form, wherein the branchiæ are gradually absorbed to give place and function to the proper internal lungs of the higher groups. The heart is three-chambered, with two auricles and one ventricle. These creatures are reproduced by means of eggs that are soft, small in size, and brought to perfection in water, or in moist situations.

ORDER—ANURA (*Tailless Batrachians*).

THIS order embraces the families of Frogs and Toads. The principal characteristics are a nearly or quite naked body, particularly short and broad; absence of tail; and a long intestinal canal.

FAMILY—RANIDÆ (*Frogs*).

Tailless Batrachians, with the tongue adherent in front, more or less free behind. The fingers are four in number, the toes five, usually webbed. Fourteen genera are enumerated, and about fifty species.

COMMON FROG (*Rana halecina*).—Called, also, the LEOPARD FROG. It is named Shad Frog in Pennsylvania, from the fact that it appears with the shad in the spring. Habitat, North America generally.

PICKEREL FROG (*R. palustris*).—This is common in the eastern portions of the United States.

GREEN FROG (*R. clamitans*).—Called, also, SPRING FROG, and R. horiconensis, Holbrook. Is a handsome species, bright green, spotted with blackish. Inhabits the United States east of the Rocky Mountains.

BULL FROG (*R. catesbiana*).—R. pipiens of other authors. This is the majesty of all Ranine realms—the head and front of Frogdom. It is common in all parts of the Eastern States.

THE WOOD FROG (*R. temporaria*).—This is an European species, common in the eastern portions of the United States. Two varieties are known, R. cantabridgensis and R. sylvatica.

FAMILY—SCAPHIOPIDÆ (*Spade Foots*).

Terrestrial Frogs, with a heel provided with a more or less developed spur. Three genera and ten species are found in America, Europe and Australia.

SOLITARY SPADE FOOT (*Scaphiopus holbrooki*).—This inhabits the Eastern United States. Not very common. It is the S. solitarius of Holbrook.

FAMILY—HYLADÆ (*Tree Frogs*).

This family embraces arboreal forms of small size, having the fingers and toes adapted for adhering to smooth surfaces by means of small discs. Ten genera and sixty species are known, very generally distributed. Their exceedingly shrill voices are well known.

COMMON TREE TOAD (*Hyla versicolor*).—This form is very abundant and familiar in the East United States. H. pickeringii and H. andersonii are less common. The latter is found from New Jersey to South Carolina, and is very rare.

TREE FROG (*Chorophilus triseriatus*).—Habitat, East United States.

CRICKET FROG (*Acris gryllus*).—Inhabits the eastern portion of the United States. A variety, crepitans, is known.

FAMILY—BUFONIDÆ (*Toads*).

These are toothless forms, with webbed toes, not provided with discs. The skin is peculiarly warted. Three genera and thirty species are known throughout the world. Australia is the only exception.

AMERICAN TOAD (*Bufo lentiginosus*).—Very common throughout the United States. It varies considerably. The northern form is variety americanus.

ORDER—MODELA (*Salamanders*).

THESE forms are naked, elongated, with four developed limbs. The adult has no external branchiæ, the latter being absorbed, and the habits of the creature so changed, that it remains out of water much of the time, and breathes air through proper lungs.

FAMILY—PLEURODELIDÆ (*Newts*).

SPOTTED TRITON (*Diemyctylus viridescens*).—Called NEWT and EFT. Abundant in the eastern portions of the United States. Found in ponds and brooks. The Red Eft (D. miniatus) is regarded as a variety of the preceding.

FAMILY—DESMOGNATHIDÆ.

This family resembles the preceding, but there are important differences in the skeletal characters.

YELLOW SALAMANDER (*Desmognathus ochrophoca*).—Called, also, the DESMOGNATH. Inhabits the Alleghany Mountains. The Dusky Salamander (D. fusca) inhabits from Ohio to Massachusetts, and southward, and is one of the commonest species in springs and brooks. The Black Salamander (D. nigra) is the largest of the eastern species. Inhabits from Pennsylvania southward.

FAMILY—PLETHODONTIDÆ.

These are distinguished by the name American Salamanders. There are eleven genera and thirty species, nearly all of them North American.

FOUR-TOED SALAMANDER (*Hemidactylium scutatum*).—Inhabits from Rhode Island to Illinois, and southward. It is the S. melanosticta of Gibbes.

RED-BACKED SALAMANDER (*Plethodon erythronotus*).—Common in the Eastern States. A variety, P. cinereus, is without the red dorsal band. The Viscid Salamander (P. glutinosus)—chiefly terrestrial, like the preceding—is found in same localities.

TWO-STRIPED SALAMANDER (*Spelerpes bilineatus*).—Called CAVE SALAMANDER. Inhabits from Maine to Wisconsin, and southward. S. longicaudus abounds in the caves from Maine to Kentucky. The Red Triton (S. ruber)—Pseudotriton of Baird—is found from Maine to Nebraska, and southwards.

PURPLE SALAMANDER (*Gyrinophilus porphyriticus*).—A large aquatic species, inhabiting the Alleghany Mountains. It is the Spelerpes salmonea of Storer and Gray, and is said to be the only Salamander that exhibits any efforts at self-defense, others being sluggish and inactive.

FAMILY—AMBLYSTOMIDÆ.

One genus and nineteen species are recorded, supposed to be all American. They are particularly abundant in the south and west of the United States. Until recently these forms were regarded as distinct from the Siredon. The larvæ (see Plate 4, fig. 2), or imperfectly-developed forms of the Amblystoma, are now known to attain the Siredon state.

MOLE SALAMANDER (*Amblystoma talpoideum*).—Inhabits from Southern Illinois southward. There are eight other species enumerated, found respectively in Ohio, New Jersey and southward. Specimens kept in the New York Aquarium have, during the summer of 1878, passed through the various stages of transformation. The tail was first noticed to be gradually becoming smaller, and, on absorption of the branchiæ, was in a few weeks complete. The more delicate and comely Salamander, with proper internal lungs, and its body prettily decorated with round spots, was the perfect and permanent form. This process of change was clearly visible in the well-arranged tanks of the Aquarium. The larva state of one species is the curious Axolotl of Mexico and Lake Como, Western Territories. (See Plate 4, fig. 2.)

FAMILY—MENOPOMIDÆ.

This family embraces large-sized Salamanders, with the form of the preceding. They are aquatic, with well-developed legs. One genus and two species are known.

HELLBENDER (*Menopoma alleghaniense*)—Plate 3, fig. 1).—Called, also, the BIG WATER LIZARD. This is rather a repulsive creature, though perfectly harmless, as are all of this group. It is about one and a half to two feet in length. Specimens are kept in the New York Aquarium, where the habits are well observed. It inhabits the Mississippi and Ohio rivers, and southward.

FAMILY—AMPHIUMIDÆ (*Congo Snakes*).

These forms are Salamanders of great size, with an almost serpentine body. The limbs are rudimentary, with two or three toes each. They are aquatic. Two genera and two species are known.

TWO-TOED CONGO SNAKE (*Amphiuma means*).—Vol. II, p. 99, fig. 28. Inhabits South Carolina, Florida, Alabama, Mississippi and Louisiana. The genus Munænopsis has one species. They are both found in the ditches and small streams of the Southern States.

ORDER—PROTEIDÆ (*Tailed Batrachians*).

FAMILY—PROTEIDÆ (*Mud Puppies*).

MUD PUPPY (*Necturus lateralis*).—Called, also, WATER DOG, MENOBRANCHUS, DOG-FISH. Is common north and west of the Alleghanies; abundant in the Great Lake region. Its length is nearly two feet.

FAMILY—SIRENIDÆ (*Sirens*).

The Sirens are elongated in body, eel-like, and have no posterior limbs. The pelvis is entirely wanting. The lower jaw is well provided with teeth, the upper has none. The eyes are very small. Two genera and two species are known.

THE GREAT SIREN (*Siren lacertina*)—Plate 4, fig. 1.—Inhabits North Carolina, Southern Illinois, and southward. Its length is about three feet. Psendobranchus striatus is a small species, found in Georgia.

HISTORY

OF

THE AMERICAN FAUNA.

FISHES.

Ichthyology—from ἰχθύς, fish, and λογος, discourse—is a term which has long been in use to indicate that branch of zoölogy that treats of the lowest class of vertebrate animals. The word fish follows from the Anglo-Saxon *fisc*, and is closely like the German *fisch*, the Dutch *visch*, and the Scandinavian *fisk*. The popular idea of a fish is very indefinite. There are many creatures living in the ocean, and in rivers and lakes, that are by no means Fishes, but are air-breathing mammals, having warm blood, and suckling their young. Some of these creatures, though living in the water quite as habitually as Fishes—Whales, for example—must yet come to the surface to breathe the external air, for they have lungs, and not gills. Seals, Porpoises and Manatees are of this class, notwithstanding the Roman Catholic edict that pronounces their flesh "fish," as a special indulgence. Fishes are cold-blooded vertebrates, that inspire air through the medium of water in which they dwell; gills, or branchiæ, accessible through apertures in the sides of the head, affording the requisite substitute for the enclosed lungs of the land animals. The delicate, branching blood-vessels, that are easily seen on parting the gill covers, are in immediate contact with the water, and receive the vivifying influence of the air contained therein, directly, through the constant flow taken in at the mouth and forced out at the gill openings. The heart of Fishes is simple, consisting only of two chambers. The skeleton of true Fishes is provided with a furcula-shaped bone—like the "merry-thought" of Birds; and scapular bones, with adjunct appendages, are joined together beneath, on the medium line. Connected with these bones are the pectoral fins, which represent the anterior extremities. Other fins are developed singly or unpaired, and are made up of rays connected with the skeleton, through the intervention of interspinous bones that float between the processes of the vertebræ. Most Fishes are provided with scales, but in some instances the skin is thick and smooth, and covered with mucous, which exudes from numerous glands that are situated in a row along the sides, called the lateral line. Agassiz regarded the other species of apertures seen in the sides of Fishes as spaces for the admission of water to the circulation, through a series of tubes that end in blood-vessels near the heart. In the Shad these tubes are easily seen. They are supposed to be useful in balancing the pressure in deep-water Fishes, when suddenly changing from shallows to great depths. The scales of Fishes are secreted from little folds of skin. Four prominent forms are seen, called, respectively: *Cycloids*, those having concentric lines; *Ctenoids*, having toothed edges; *Ganoids*, having enamelled scales; and *Placoids*, which are large and plate-like; the last having the substance called "shagreen," and in some instances the prickles and prominences developed into real dentine.

The hearing apparatus in Fishes is concealed within the head. In the *Plagiostomes* and *Cyclostomes* it is placed in a special cavity, and included in a cartilaginous labyrinth. In the former the canal is prolonged beneath the skin, and extends to the upper part of the cranium. In the Rays, also, it is prolonged similarly, and opens externally by several small apertures. The swimming bladder is connected, in some instances, with the cranium, through the medium of a chain of several small bones. In nearly all Fishes there are large semicircular canals, and a vestibule connecting with a chamber that contains the curiously-formed ossicles or ear-bones, some of which are very hard, and others quite limy and soft. The eye is seldom provided with eyelids, having free edges; some Sharks have a third or nictitating membrane. The organ of smell does not communicate with the mouth, except in the case of the Myxinoids. Taste is very weak; though the tongue is sufficiently large, it is mostly used for prehension—even the teeth are often situated on portions of it. Touch is developed in certain organs, the lips being partially possessed of this function. Filaments upon the lips and head are probably sensitive, and warn the creature of danger, as well as indicate the nature of prey. In most osseous Fishes the sexes do not come together, but the eggs are sprinkled with milt, or seminal fluid. A few bony Fishes are viviparous. The Rays and some Sharks are oviparous, their eggs being firm and leathery, like those of some reptiles.

Though Fishes may be said to be especially inhabitants of the waters, yet there are certain variations from the rule. It would seem most natural that

water must be pure, and well-charged with oxygen, that the delicate vessels which ramify through the gills may readily absorb the life-giving pabulum. There are, however, Fishes that seem rather to inhabit the mud and sands at the bottom of the water, as, for example, the Flat-fishes—Flounders, Sole, Plaice, etc. The Silurus fossilis is so called because it is not seen excepting when actually dug out of the mud. These are not, however, wholly removed from the influence of the water above them. There are Fishes that are capable of leaving the water entirely, roaming abroad, and temporarily abiding on the earth. Eels frequently crawl along the slimy grass, during the night, from one piece of water to another. The Soldier loricaria, found in Surinam, is described as not only passing over land, but actually burrowing to find water more acceptable. The most astonishing feat is performed by the Climbing Perch (Anabes scandens), a native of Asia, which actually passes over dry and high banks in its search for pools of deeper water. These Perch are known to live five or six days out of water, and it is noticed that the gills are expanded during the time they are thus exposed. The structure of the pharyngeal bones in this species is so modified as to present support for certain labyrinthine cells, which retain a small quantity of water, sufficient to moisten the gills. It may be noted that the most remarkable deviation from the normal life and habits of this class is seen in the small group of Flying-fishes, some of which are able to maintain a continuous flight for a few seconds; but their strictly fish-nature requires that they return to breathe beneath the waters.

Fishes are nearly of the same specific gravity as water, consequently they move with great ease, in all directions. The usual mode of progression is by the strong muscular tail, the action of which is imitated in "sculling" a boat. Other fins are but little used, except for balancing. Among the singular analogies met with in Fishes is that of the possession of a pouch, formed of two soft flaps, seen in the Pipe-fishes and Sea-horses. Here is a marsupial fish! although in these instances the male possesses the marsupium. The genus Aspredo, of the *Siluridæ*, exhibits the strange condition of hemispherical depressions in the belly of the male, within which the eggs are deposited, not unlike those of the Surinam Toad. Some species of Pipe-fish are credited with this habit. Well authenticated instances of nest building are known, as in the case of the familiar Stickleback. The wonderful change of color that certain Fishes undergo is not satisfactorily accounted for. Mr. Farrell ascribes it to the effect of mental agitation. The Stickleback is a notable instance of this apparent "emotion," and is particularly subject to radical changes of color. Great changes are noticed in the colors of the same species in different localities, and in no class of the Animal Kingdom are there more instances of the power of simulating the colors of their surroundings. The remarkable work of M. Sauvigny exhibits no less than eighty-nine different varieties of the Golden Carp, including the richest colors, both uniform in tint and parti-colored in the most grotesque manner.

Besides the immense commercial importance of a large number of species of Fishes, there are various products which serve more or less valuable purposes. The early writer, Belon, describes the use of the "ear-bones" as proving "infallible in certain complaints." Shagreen is an article derived from some species of Sharks and Rays. Pliny mentions that the Romans were in the habit of using this substance for polishing ivory and wood. The rough skin of the Rays forms a very beautiful and useful shagreen, which is used in covering scabbards and surgical instruments. The isinglass of commerce is derived from a species of Sturgeon; and a kind of glue is made from the common Cod. Edible Fishes are exceedingly numerous on the coast of North America. One hundred and seventy species are described as known in the New York market.

The early literature of *Ichthyology* presents some exceedingly crude though interesting ideas, that were entertained by the ancients. Through the liberality of its president, the American Museum of Natural History, in New York, is now in possession of the large and most valuable Ichthyological Library which was collected by J. Carson Brevoort, Esq. This unusual source of information we have fully consulted, and have endeavored to present herein as much of the matter, dating from the earliest to the present time, as will contribute something like a complete history of *Ichthyology* in outline. The name of Hippolyti Salviani stands clearly prominent, not only as the first reliable author, but as one that is most honorably connected with one of the best-illustrated works, either of modern or ancient times. Salviani was born in Italy, A.D., 1514, of noble parentage; was Professor of Medicine in the University of Rome and physician to Pope Julius III. In these early times, when nothing had been done in Comparative Anatomy, this writer commenced the examination of the interior of his subjects. His work is a folio volume of 500 pages, published in a very stylish manner, the general execution of which is not surpassed at the present day. A large full-page copper-plate portrait of its author, with exceedingly fine accessory portions, including arms, etc., bears the following title: *Aquitalium Animalium Historiæ Romæ, mdliiii.* Then follow tables and chapters, which have an aspect of more system than the miscellaneous collections of fabulous and truthful matter seen in previous authors. There are about one hundred copper-plate engravings, which, to use the language of Sir William Jardine, who has copied largely from the work, "have not been surpassed for fidelity and beauty in modern times." Certainly nothing has yet appeared to excel in beauty and artistic accuracy these large copper-plate engravings. The work of Conradi Gesneri, *Historiæ Naturalium, etc.*, 1558, is a large folio, with numerous wood-cuts, many of them well drawn, but coarsely executed. The works of Oppian and Pliny are but little more than records of fanciful stories of animals, many derived from Aristotle. From these we have extracted some interesting accounts relating to species well known from the earliest times, and equally known in the

Mediterranean Sea and our Atlantic waters. The work of Belon, published in 1545, from which we have extracted some items, contains figures of many familiar Fishes. The illustrations are excellent in drawing, and the engraving is passably executed on wood. Rondelet's *L'Histoire Entiere Des Poissons*, 1548, is a more serious and pretentious work, with crude, though tolerably accurate wood-cuts. After treating the Fishes very fairly in one group, the same title covers chapters on the Cetaceans, Seals and Sea-Turtles. Among the Cetaceans he places a form with the snout of a Saw-fish, and body and tail of a Whale; then there are scaled Lions and scaled Mermen; and, after describing the Shell-fish and Radiates, with many very good figures, he gives two separate chapters for the Fishes of lakes and rivers, respectively. A description with an illustration of a Sea Serpent (*Du Serpent d'eau*) is given, ending with some exceedingly uncouth figures of Reptiles. The first of three eras which Baron Cuvier recognizes in the science of *Ichthyology*, embraces the experience and teachings of Aristotle. The second dates from the time of the authors noticed above—about the middle of the sixteenth century—Salviani, Belon and Rondelet, as well as Gesner, Aldrovandi, and a few others of less note. From the illustrated works of these old authors we have introduced, in the proper places, such of the quaint matter we have found referring to American species, and thus given a history of our Fishes from the earliest times.

The typical Fishes, called *Teleosts*, from the Greek, "perfect bone"—bony Fishes—include the largest number of familiar forms. The *Ganoids* are not now numerous, though they were largely represented in early times. The Gar-fish, or Alligator-gar, is an example of this group. The *Dipnoans* are represented by the Lepidosiren of South America. The Sturgeons are of the same group.

There are now about nine thousand species of Fishes known to science; the larger number being found in tropical waters. Numerous families are wholly represented in fresh-water. Seven families are peculiar to North America. Ten families are exclusively known in tropical America. The present state of the science is exhibited in the following distribution:

Class—PICES or FISHES.

Sub-class—Teleostei.

Sub-class—Ganoidei.

Class—SELACHIANS or ELASMOBRANCHIATES.

Class—MARSIPOBRANCHIATES.

Class—LEPIDOCARDII.

Our account of the Fishes of North America will be in two parts. The valuable *List of the Fishes of the East Coast of North America*, by Dr. Gill, has been followed as to the arrangement of families. The Fishes of the lakes and rivers are recorded after the arrangement in Dr. Jordon's *Manual of Vertebrates*. The exhibition in that work of the numerous trivial names is especially interesting and valuable for a popular treatise.

Fossil Extinct Fishes.

In the upper portion of the Upper Silurian deposits, fossil extinct Fishes are found to a certain extent in Europe. None of this formation has been discovered in America. Fishes being the lowest of vertebrates, they are also first to appear in geological history. Their earliest appearance in America is in the Devonian strata. The *Amphibians*, the next higher group, appear in the Lower Carboniferous. The oldest-known Fishes are of the Shark groups and an extinct group, the Buckler-headed Fishes. The earliest Fishes found in America are not numerous, but are very large in size. The Triassic deposits of New Jersey and Connecticut River valley abound in remains of small *Ganoids*. Among the *Elasmobranchiates*, the extinct genus Rhyncodus has been found in the Corniferous Limestone of Ohio. This is allied to the singular *Chimæra* of the present day. The *Ganoids* are represented by genus Amia, with several species, which lived in the great lakes; one species, only, exists at present. Remains of Lepidosteus are found in Tertiary rocks. Giant Fishes, called Dinichthys and Aspidichthys, are found in the Devonian rocks of Ohio. These belong to the *Placoderms*, and had the anterior portion of the body covered with thick bony plates, which are in some instances studded like a coat-of-mail, with excessively hard enamelled projections; behind, the body was usually either naked or covered with angular enamelled scales. In Dinichthys, the largest *Placoderm* yet discovered, the defensive and offensive armor is most formidable. "Its size," says Dr. Newberry—who is identified with the discovery and scientific presentation of these wonderful forms—"may be conjectured from the fact that a single plate, occupying the centre of the back, was more than two feet long and broad. The head was about three feet in diameter and length. The mandibles were two feet in length by six inches in depth, solid bone throughout." Of the *Pycnodontidæ* a few have been found. The genus Platysomus has been obtained from the coal measures of Illinois, and Pycnodus from the greensand of New Jersey. The *Dipnoans* are represented only by three living forms, the Lepidosirens and Ceratodus, and closely allied to the *Amphibia*.

Family—MALTHEIDÆ.

BAT-FISH (*Malthe vespertilio* (*Linn.*), *Cuv.*)—Called, also, Nosé-fish, Bat-malthea and Diablo. Dr. Mitchill has described several species of this genus, all from the Bahamas. A specimen was early obtained on the banks of Newfoundland, from which circumstance DeKay says we may introduce it as occurring on our shores. It has a place in the list of the Fishery Commission, as inhabiting from Newfoundland to Florida. The apparatus by which it lures its prey is placed just over the mouth, and consists of an erectile club-shaped body, about an inch in length, situated within a cavity.

BOX-HEADED SEA-BAT (*M. cubifrons, Rich.*)—This is the M. nasuta of Cuvier, and Short-nosed

Malthea of DeKay, and supposed to be the M. radiatus of Mitchill. It ranges from Labrador to the Caribbean Sea. The Dotted Malthea (M. notata, Val.) is found in the South Atlantic seas.

FAMILY—LOPHIIDÆ.

ANGLER, OR BELLOWS-FISH (*Lophius americanus, DeKay*)—Plate 12, fig. 62.—Called GOOSE-FISH in Massachusetts, MONK-FISH in Maine, also FISHING-FROG, AMERICAN ANGLER, SEA-DEVIL, etc., with a range from Nova Scotia to Hatteras. It is often taken in Massachusetts Bay, and, from its great sluggishness and bulk, is frequently thrown ashore during the heavy storms of the Eastern Coast. We have seen a specimen which measured about three feet in length, wedged between two rocks at low tide, and its enormous mouth distended with a Cod which nearly equalled the dimensions of its captor. Its bulky form and diminutive fins would seem to indicate a sluggish habit; and, indeed, there is no doubt that its usual method of procuring prey is to lie upon the bottom, partially concealed under algæ or mud, its wide mouth ready to engulf any living thing that comes in its way. Yet Pennant records of the English species that it undoubtedly does seize large and powerful fishes. Dr. DeKay says: "The largest one I have seen was four feet long. They are not eaten, but fishermen often open them for the sake of the numerous fishes that are found in their stomachs." The remarkable dimensions of this Fish may be appreciated by noting the following measurements: Dr. Storer's specimen was forty-four inches in length and thirty-five in breadth, with a gape of mouth nine inches in extent. This Fish derives one or more names from the fact that two or three of its dorsal fin-rays are developed into separate and moveable rods, one of which is especially adapted to entice its prey within reach of its mouth. During our sojourn with the Fishery Commission in the summer of 1878, we had an opportunity to secure a very large specimen of this Fish, upon which the peculiar fishing apparatus was perfectly developed. There were three separate fin-rays, each from one to two inches apart, and each one entirely naked, save the foremost, which had a small burgee, or flag-like filament. On carefully dissecting the structure, there is seen situated on the top of the cranium a consolidation of several interspinous bones, supporting two of the fin-rays. The anterior fin-ray is so developed as to be an exact counterpart of an eye-bolt and chain-link, with the upper prolonged into a rod. The structure of the Fish is very interesting and beautiful in itself, so perfect is the analogy and so apparent the design. The next rod, in the rear, is much like the first, but is articulated nearly as all fin-rays are, by suture in the articulating head, which, instead of allowing a complete perforation of the interspinous bone and its embracement, is articulated nearly as in the normal manner, allowing only the same forward and backward movements as with the ordinary fin-rays. A third ray or rod is situated some three inches in the rear, on a separate and smaller interspinous bone, and more nearly resembles the normal articulation. The anterior rod, then, is the only one that seems to be at all capable of use, and this is moveable in all directions. It reaches, when projected forwards and downwards, just before the mouth, and is no doubt intended to allure by its gentle agitation the creature's prey within reach of its enormous mouth. The small flag-like fillet on the end of the rod attracts the attention of the prey, when, at the critical moment, the great head and shoulders are suddenly raised, and even fishes of large size are snapped in. The pectoral fins are extremely stout and feet-like, and readily afford the creature means and power to quickly seize upon passing prey. Belon calls it *Le Diable de Mer*, or *La Grenoille de Mer* (Sea-frog). He figures it tolerably well, excepting that the pectoral fins are drawn as paws, and a second pair of even more paw-like limbs are placed in the rear, which seem to be wholly fictitious, though the dorsal and anal fins are entirely omitted. He ranks it with the Rays. Rondelet's figure has the characteristic outline of the Fish, with pretty correct details. His trivial name is GALANGA, and he places it between the Rays and Sharks. Storer says: "I am assured that entire sea-fowls are swallowed by this Fish, and Capt. West, of Chilmark, informed me that he had known a Goose-fish to be taken with six coots in fresh condition in his stomach."

FAMILY—CERATIIDÆ.

TUFTED FROG-FISH (*Himantolophus grœnlandicus, Reinhardt*).—Habitat, Greenland. One species of Oneirodes—ESCHRICHT'S FROG-FISH—and one of Ceratias—HOLBOLL'S FROG-FISH—are from the same locality.

FAMILY—ANTENNARIIDÆ.

TOAD-FISH (*Pterophryne lævigata* (*Cuv.*), *Gill*).—Called, also, COMMON FROG-FISH, MOUSE-FISH, and, in Cuba, PESCADOR; in Bermuda, DEVIL-FISH. It is an oceanic Fish, accidental on the coast.

FAMILY—ORTHAGORISCIDÆ.

GLOBE-FISH (*Molacanthus nummularis* (*Walb.*), *Gill*).—This is regarded as a pelagic species, and only accidental on the coast. Dr. DeKay records a Globe-fish—Acanthosoma carinatum—which Dr. Mitchill, one of the first who described the Fishes of New York, mentions as being noticed on our coast, and names Diodon.

SUN-FISH (*Mola rotunda*)—Plate 13, fig. 68.—This has long borne the generic name Orthagoriscus. The present nomenclature is referred to Cuvier. DeKay records it as THE SHORT-HEAD FISH (O. mola). Linnæus named it Tetraodon mola; Mitchill, Cephalus brevis; and Storer, O. mola (the Short Sun-fish). In Cuba it is called Pez mola. Several species are known, but the present is the only one found near our Atlantic shores. Like some other species, it seems either to have been very rare in

earlier times, or, like the Leather Tortoise, to have escaped the attention of fishermen and naturalists. Even in 1842 DeKay, in *New York Fauna*, refers to Storer's notice of the Fish as "the only detailed account which we have had of this species on this side of the Atlantic," and adopts the latter's description. DeKay says: "The Great Sun-fish, or Head-fish, is not unfrequently captured along the coast. * * * It is known to weigh four or five hundred pounds." Storer, in *Fishes of Massachusetts*, 1839, remarks: "This is not a common Fish in Massachusetts Bay. Its motions are very sluggish, and it swims near or upon the surface of the sea." The unique character of the Fish may be somewhat appreciated by the consideration of its dimensions. It bears something near the appearance of a Shark, with its body abruptly truncated just behind the pectoral fins, the dorsal and anal fins being very large and high, and directly opposite to each other. Its skin is similar to that of the Shark. The creature is quite thin and compact, and measures (in one instance, when the weight was two hundred pounds,) forty-five inches in length and thirty inches in depth. The abruptly truncated terminal portion is edged with a thin and narrow border, quite fringe-like, which answers to the tail. The dorsal fin in the above specimen was thirteen inches in length and twenty-one inches high; the anal fin was twelve inches long and twenty-one inches high; the pectorals were four inches long and seven inches high. The Sun-fish is now seen in the waters of Massachusetts Bay quite frequently during the warmer months. We have several times encountered it, and always when it seemed to be on its side, as if floating; and, when disturbed, it very clumsily left the surface and disappeared. We have taken some pains to ascertain whether this Fish is ever seen swimming upright, as it is evidently intended to do, and all observers that we have known agree in stating that the Fish is always seen in the above position. Rev. J. G. Wood, in his *Illustrated Natural History*, states that "The flesh of the Sun-fish is white and well-flavored, and is in much request among sailors." This does not correspond to our experience, nor to that of Dr. Storer, who says: "On account of the great elasticity of its flesh it is captured with great difficulty; it is generally gaffed at or near the branchial apertures. Its flesh is sometimes used for balls." Portions cut from its sides and shaped into balls will rebound like rubber; and one would as soon think of eating the latter substance. One of the largest specimens was captured on our coast off Florida, and exhibited in the New York Aquarium. It measured about five feet in length. Like other sluggish Fishes of great size it is infested with parasitic forms. The Pennella and Tristoina are almost always found attached to the gill-edges, or beneath the fins, and several other forms are common. In the *Report of the United States Fishery Commission*, the range of this Fish is given as from Newfoundland to Cape Hatteras. Rondelet figures the Mola remarkably well, calling it *Lune ou Mole*. The latter term, according to this author, is derived from the resemblance to a millstone, *meule;* and in Spain it is called *Bout*, referring to its stump-like body. Pliny records it as *Rota*, a wheel, which is confounded by old writers with "a Whale or great Sea-fish." Mola, which is retained as the specific term, seems to have the above derivation.

FAMILY—DIODONTIDÆ.

THE SPRING BOX-FISH (*Chilomycterus geometricus*).—Called, also, RABBIT-FISH, from the supposed resemblance of the flesh to that of the Rabbit. It is found from Cape Cod to Hatteras. Plate 15, fig. 75.

THE HAIRY BOX-FISH (*Trichodiodon pilosus*).—Called, also, BLEEKER. This is the same as named by Mitchill. Habitat from Cape Cod to Hatteras.

FAMILY—TETRADONTIDÆ.

SMOOTH PUFFER (*Tetrodon lævigatus, Linn.*)—Found from Cape Cod to Hatteras.

ROUGH PUFFER (*Chilichthys turgidus* (*Mitch.*), *Gill*).—Named the PORCUPINE-FISH, BLOWER, SWELL-FISH, and in Cuba, TAMBOR; described by Storer from specimens taken in Boston Harbor and at Vineyard Sound, and is common in the latter waters. In New York it is known as Toad-fish. Dr. DeKay remarks that it is frequently taken while fishing for Black-fish, and is even found in company with Cod and Haddock. It gets its name from its singular habit of puffing into a nearly complete globe, when irritated. Habitat from Cape Cod to Florida.

FAMILY—OSTRACIONTIDÆ.

TRUNK-FISH (*Lactophrys trigonus* (*Linn.*), *Poey*).—Called, also, BOX-FISH. Is accidental on our coast, and native to Cuban waters. Dr. Storer records a specimen of Ostracion which he says Dr. Yale, of Martha's Vineyard, sent him in 1833. This was named at that time O. yalei, but is, no doubt, the species here recorded.

FAMILY—BALISTIDÆ.

LONG TAILED FILE-FISH (*Alutera cuspicauda, DeKay*).—This is indicated by Baird as a doubtful species. Mitchill called it SHARP-TAIL (Balistes cuspicauda); and Storer, the UNICORN FILE-FISH (A. monoceros). It is found from Cape Cod to Florida.

HOG-FISH; FILE-FISH (*Ceratacanthus aurantiacus* (*Mitch.*), *Gill*).—Called, also, the ORANGE FILE-FISH. Habitat, Cape Cod to Florida.

STORER'S FILE-FISH (*Stephanolepis massachusettsensis* (*Storer*), *Gill*), *d. s.*)—FOOL-FISH in New York. Found from Nova Scotia to Florida.

EUROPEAN FILE-FISH (*Balistes capriscus, Linn.*)—Called in Bermuda the TURBOT. Found from Nova Scotia to Florida.

POWEL'S FILE-FISH (*Balistes poweli, Cope.*), *d. s.*)—Considered to be an accidental species. Named for Mr. Powel, of Newport, R. I.

FAMILY—HIPPOCAMPIDÆ.

SEA-HORSE (*Hippocampus hudsonius, DeKay*).—Known as HORSE-FISH in some localities. Ranges from Cape Cod to Cape Hatteras. Storer records this as SHORT-NOSED SEA-HORSE (H. brevirostris),

from Holmes' Hole. DeKay has it, HUDSON RIVER SEA-HORSE; Schoepff, THE SEA-HORSE AT NEW YORK; and Mitchill, in *Fishes of New York*, SEA-HORSE PIPE-FISH (Syngnathus hippocampus). This Fish is regarded as the only one among members of its class which has a prehensile tail. The length varies from three to six inches.

FAMILY—SYNGNATHIDÆ.

PIPE-FISH (*Syngnathus peckianus, Storer*).—This curiously-formed Fish was first described by Dr. Storer, of Boston, from a specimen sent him from a sea-water pond near Holmes' Hole. He named it in honor of Wm. D. Peck, an early naturalist and ichthyologist of Maine, who wrote on the Fishes of New Hampshire in 1794. DeKay records a Banded Pipe-fish (S. fasciatus), and Green Pipe-fish (S. viridescens). Dr. Storer describes Brown Pipe-fish (S. fuscus), which he regards as identical with a specimen described earlier by Dr. Mitchill as S. typhle. As there is only one species introduced in Baird's *List of East Coast Fishes*, we presume that the S. peckianus is a synonym for all. Plate 14, fig. 70.

FAMILY—FISTULARIIDÆ.

TOBACCO TRUMPET-FISH (*Fistularia tabaccaria, Linn.*)—Plate 10, fig. 49.—Also, UNARMED TRUMPET-FISH. Baird regards this as "occasional; specimens obtained at New York." Habitat, Cape Cod to Florida. Dr. Storer records a Tobacco Pipe-fish (F. serrata) which was taken at Holmes' Hole, which is probably the same as the present. DeKay mentions the same as the American Pipe-fish. The present species he records as Spotted Pipe-fish. Mitchill described the latter as New York Trumpet-fish (F. noveboracensis). According to Baird there is only one species.

FAMILY—GASTEROSTEIDÆ.

FOUR-SPINED STICKLEBACK (*Apeltes quadracus (Mitch.), Brevoort*).—Gasterosteus quadracus, Mitchill; BLOODY STICKLEBACK (G. apeltes), Storer. The Sticklebacks are exceedingly interesting and intelligent; they are bold and lively, and prove the most satisfactory denizens of the house aquarium. Their voracious and pugnacious habits are a never-ending source of amusement. The habits are, probably, varied among the different species. One kind we have seen in considerable numbers inhabiting the rapids of a small stream of fresh-water, just where it empties into the sea at Swampscott, Mass. It is almost a cause of regret that these interesting little Fishes are not of more striking proportions, as they would then be more easily observed. We have been highly amused and edified in witnessing these creatures, week after week, at the New York Aquarium, where they spawned and bred successfully. Their pugnacity at such times, and particularly when the spawn is laid and under the care of both parents, is wonderful. The Stickleback is one of the few Fishes that builds a nest deliberately, and therein deposits its eggs. The minutest bits of straw or other *debris* are drawn together and formed into a nest, not unlike that of the Oriole—a rounded form with a hole in the side. The entrance is frequently concealed by drawing fragments over it. The nests made in this manner have almost the consistency of those of Birds, holding together when taken from the water. The nest which was built in the New York Aquarium was merely a shallow excavation on the bottom, lined with a few bits or shreds of grass; over this the pair kept a most vigilant watch until the young were able to swim around the tank. There are several species in England, where they have the name of TITTLEBAT, PRICKLE-FISH and SHARPLIN. Others have longer names, and more distinctive, as HALF-MAILED, QUARTER-ARMED, SMOOTH-TAILED, etc. The present species is found from New Brunswick to Florida. The COMMON STICKLE-BACK (Gasterosteus aculeatus, Linn.) is recorded as ranging from Greenland to Newfoundland. Dr. DeKay mentions this under the name New York Stickleback (G. noveboracensis), and Storer as the same, with habitat, Provincetown, Mass., and Boston, Mass. The TWO-SPINED STICKLEBACK (G. biaculeatus), a doubtful species according to Baird, is from Newfoundland and Labrador. Mitchill records the same; and DeKay says: "It is found about New York in salt-water streams, and Hudson River as far up as Albany." G. niger, Cuv. and Val., is another doubtful species. Habitat, New Brunswick to Hatteras. G. noveboracensis, Cuv. and Val. (New York Stickleback), is recorded by Baird as doubtful. Habitat, New Brunswick to Hatteras.

TEN-SPINED STICKLEBACK (*Pygosteus occidentalis (Cuv. and Val.), Brevoort*).—Habitat, Newfoundland to Hatteras. Dr. Storer describes this as above—G. pungetius, Linn. Found at Salem, Mass. DeKay found it in both salt and fresh-water, and in the harbor of New York in company with the Pipe-fish, and also from a fresh-water pond on the island of New York, where the communication with the sea is interrupted the greater part of the year.

FAMILY—SOLEIDÆ.

LONG SOLE (*Plagusia plagiusa (Linn.), Gill.*)—This is recorded as of doubtful identity as regards others. Habitat, from Newfoundland to Hatteras.

AMERICAN SOLE (*Achirus lineatus (Linn.), Cuv.*)—This is Pleuronectes lineatus, "SOLE IN NEW YORK," Schoepff; P. mollis, NEW YORK SOLE, Mitchill. Dr. Storer found it at Holmes' Hole, where a notion prevailed that the flesh was poisonous, though only one specimen was found, and that certainly not eaten. Dr. Mitchill gives more reasonable testimony, as he states positively that the flesh is "delicate eating." DeKay says: "It is common in our waters—usually taken in seines in September and October, but is too small to be of much importance as food. I have eaten of them and found them very delicate." It is called CALICO, and HOG-CHOKE, and COVERCLIP, in New Jersey, and SPOTTED SOLE in Massachusetts Bay. Found from Cape Cod to Florida. It is taken

as high up the Hudson River as Peekskill. It is extremely tenacious of life; Dr. DeKay kept one alive four days out of water. The old authors give very good figures of this Fish, placing it near the Rays. Rondelet gives *La Petite Sole ou Lingulam*, and Belon, *La Sole, Lingulaca, Buglossa.*

FAMILY—PLEURONECTIDÆ.

PUTNAM'S FLAT-FISH (*Euchalarodus putnami, Gill*).—This is, so far, only found in Salem Harbor, Mass., and named in honor of Mr. Putnam, of Salem.

THE COMMON FLOUNDER (*Pseudopleuronectes americanus* (*Walb.*), *Gill*).—Called, also, WINTER FLOUNDER and MUD DAB in Massachusetts, and SOLE in New York. Habitat, Nova Scotia to Cape Cod. This Flounder is a very familiar Fish, especially so to the small boy who waits so patiently on the wharves of salt-water harbors. It is the most common species in our waters, and is subject to great variation. Mitchill mentions seeing one with the upper surface entirely white, and another with a yellow margin on the lower side. DeKay obtained a specimen "which presented the remarkable peculiarity of being not only *reversed*, but *doubled*. Its color on both sides was uniform bronze, with a white patch on its right side near the chin, almost entirely denuded of scales." It is called NEW YORK FLAT-FISH (Platessa plana). In Massachusetts it is universally called THE FLOUNDER.

RUSTY DAB (*Myzopsetta ferruginea* (*Storer*), *Gill*).—Called SAND DAB in Maine. It ranges from Nova Scotia to Cape Cod. Storer says: "This species is occasionally brought to the market in the winter season only. It is taken in about thirty fathoms of water." DeKay calls it the RUSTY FLAT-FISH (Platessa ferruginea), and says: "The fishermen consider it rare, and only found in deep water."

AMERICAN DAB (*Limanda rostrata* (*Storer*), *Gill*).—Found in Labrador waters.

SMOOTH PLAICE (*Pleuronectes glaber* (*Storer*), *Gill*).—Named, also, SMOOTH-BACK. Found from Maine to Massachusetts.

LONG DAB (*Glyptocephalus acadianus, Gill*).—Found in Maine.

SPOTTED TURBOT (*Lophopsetta maculata* (*Mitch.*), *Gill*).—Called, in New Jersey, WINDOW-PANE, and in New York, SAND FLOUNDER. It ranges from Cape Cod to Hatteras. This was formerly described by Mitchill as the NEW YORK PLAICE (Pleuronectes maculatus), and by Cuvier as Rhombus aquosus. DeKay regards it as the WATERY FLOUNDER of Mitchill. He says: "On the coast of Massachusetts it is sold as the 'English Turbot,' from which, however, it is easily distinguished by the absence of the numerous tubercles on the colored side which characterize that species. The Spotted or Watery Turbot is regarded as a delicate article of food, and has been known to weigh twenty pounds. It is more commonly called Sand Flounder." A species called WHIFF (Citharichthys microstomus, Gill) is found from New Jersey to Cape Hatteras. The ARCTIC DAB (Hippoglossoides platessoides (Tab.), Gill) is found in the Polar regions. Another species, called the COMMON FLOUNDER, is Chænopsetta occellaris (DeKay), Gill. DeKay gives it the trivial name, THE LONG-TOOTHED FLOUNDER (Platessa), and says of it: "This is a savory Fish, common on our coast in the summer months."

SUMMER FLOUNDER (*Pomatopsetta dentata* (*Storer*), *Gill*).—Storer calls this Platessa dentata of Mitchill, and as a trivial name, THE FLOUNDER OF NEW YORK. It is known among the fishermen of Boston as SAND DAB, and is taken in the winter season near Cape Cod, in deep water. It is named the TOOTHED FLAT-FISH by DeKay, who says: "It is extremely common in our markets, and is called Summer Flounder. It is a well-flavored fish."

FOUR-SPOTTED FLOUNDER (*Chænopsetta oblonga* (*Mitch.*) *Gill*).—This is the OBLONG FLOUNDER of DeKay, and SPOTTED FLOUNDER (Platessa oblongus, Mitchill). DeKay remarks: "It is common along our coast and sandy shores, and is procured abundantly in September and October. It is excellent eating, and usually sells at from six to eight cents per pound. Like its congeners, it is very tenacious of life, and can be preserved in good condition for a long period."

THE HALIBUT (*Hippoglossus americanus, Gill*).—This is the familiar great Flat-fish of our markets, and a very superior one as an edible. It is H. vulgaris of Cuvier. Great numbers are taken in Massachusetts Bay, and on Nantucket Shoals, some reaching two hundred pounds in weight. Dr. Storer records that Mr. Newcomb, a noted fish-monger of Boston market, had on his stand a Halibut "which weighed, after the head and bowels were removed, four hundred and twenty pounds." He adds: "The largest specimen of which I have any certain knowledge was taken at New Ledge, near Portland, Me., in 1807, and weighed upwards of six hundred pounds." The Halibut fishery is at times very considerable. At the Nantucket Shoals alone there were once employed eighty vessels of from sixty to eighty tons burthen each. The Halibut abounds on both sides of the Atlantic, inhabiting the cold seas, and migrating southward in the warmer season as far as New York, returning in July and August. Some suppose that it retires to deep water in winter, without changing its latitude. Specimens are sometimes seen with the sides reversed—the eyes and colored surface on the left side. Rondelet and Belon give good figures of this Fish under the names *Flez, Helbut.* A species called GREENLAND HALIBUT (Reinhardtius hippoglossoides) is found in Greenland waters.

FAMILY—MACRURIDÆ

Two genera are embraced under this family name—Macrurus, with one species, rupestris (Bloch.), called INGMINGOAK; and Coryphænoides norvegicus, called GUNNER. They are found in Greenland waters.

FAMILY—GADIDÆ.

POLLOCK (*Pollachius carbonarius* (*Linn.*) *Bon.*)—Called in England COAL-FISH—probably from its coal-like aspect—hence its specific name. It inhabits from Greenland to Hatteras. The Pollock is at

present valued for salting, although at one time it was not prized. Dr. Storer records two species under the names Merlangus purpureus and M. carbonarius; the latter he calls Coal-fish, and the former Pollock. On the coast of New York it is not common, but in Massachusetts Bay it is exceedingly numerous. It sometimes reaches the weight of seventeen pounds, but is seldom more than half that. Great numbers are salted and sold with Cod-fish and Haddock.

COD-FISH (*Gadus morrhua, Linn.*)—Plate 6, fig. 29—is found along shore from Greenland to Hatteras. Storer named it Morrhua americana—THE AMERICAN COD; and DeKay follows with the same nomenclature. Mitchill, earlier, has it Gadus callarias—TORSCH, COMMON COD, or ROCK COD OF NEW YORK. Storer says: "This species is taken along the whole coast of Massachusetts throughout the year, leaving the vicinity of land in the month of February, and going into deeper water." A reliable source of information concerning the weight of the Cod, is the testimony of Mr. Jonathan Johnson, Jr., of Nahant, Mass., whom the writer has personally known to be a valued judge in these matters. He states that the largest Cod-fish he has seen taken weighed eighty-eight pounds. Mr. Anthony Holbrook, of Boston, a noted fish-monger, reported a specimen to Dr. Storer, which he says he saw taken in the spring of 1807, at New Ledge, sixty miles south-east of Portland, Me.; it weighed one hundred and seven pounds, and had barnacles upon its head the size of the thumb. A Mr. Holmes is recorded as stating that he has seen a Cod weighing one hundred pounds, and more than five feet in length. The Cod Fishery is a very important employment to the sea-faring people of Massachusetts.

Prof. Baird quotes from an ancient work, which was printed in 1632, to show the abundance of Cod-fishes in the early times. One chapter of this work is as follows: "Among Fishes, first, I will begin with the Codd, because it is the most commodius of all Fish, as may appeare by the use which is made of them in foraigne parts. The Codd-fishing is much used in America (whereof New England is part), insomuch as three hundred sayle of shipps, from divers ports, have used to be imployed yearly in that trade. I have seene in one Harboure, next Richmond Island, fifteen sayle of shipps at one time, that have taken in them dryed Codds for Spaine and the Straights (and it has bin found that the Saylers have made 15, 18, 20, 22 p. share for a common man). * * * The coast aboundeth with such multitudes of Codd that the inhabitants of New England doe dunge their grounds with Codd. * * Great store of trayne oyle is mayd of the livers of the Codd. In five or six hours [in Cape Cod Bay] we pestered our shipp so with Codd-fish that we threw numbers of them overboard again."

The American Cod is very voracious, attacking and feeding on smaller fish, crustacea and marine shell-fishes. During the winter months the Cod brought into Boston market and Lynn have their stomachs and intestines crowded with many kinds of small shell-fish and worms, which are obtained off the rocks in deep water. Boston market is supplied largely with fresh Cod and Haddock from small vessels sent out from Nahant and Swampscott. These vessels average about fifty tons burthen, and are built much after the model of the pilot-boats, being exceedingly staunch, and necessarily fast, as a good deal of a spirit of competition exists in the matter of reaching the market soonest. During the winter months this fishing is most important. The writer has long been familiar with the men and their methods, and it is worth while to say that no more worthy and honest class of citizens are known in our country. We have accompanied a vessel during the coldest winter weather to "Green's Harbor Ground," as they term the locality, which is a favorite Cod and Haddock region at that season. This harbor borders the Daniel Webster farm, Marshfield, Mass., but the fishing grounds are in deep water, several miles off shore. The fishermen must have certain marks on shore, by which they get the range of their ground, and certain tall trees and buildings here point out, when taken in range, the looked-for position. About two o'clock in the morning the household of the fisherman's family is astir, or the wooden firkin which contains his inevitable mince-pie, which serves for lunch, is prepared overnight. Our stalwart friend had provided us with the outfit, consisting of heavy woolen stockings and enormous boots, that were well tarred to keep out the wet. A suit of oil-cloth throughout, and a large heavy pair of woolen mittens, and oil-cloth "sou'-wester" hat completed the attire. The fishing grounds were reached about daylight, and the half-dozen men immediately commenced to get ready each his boat, or "dory," as it is called. Six of these were piled on deck like cups or saucers, one within the other. Each man and boat is dropped at intervals to pursue his fishing alone, leaving the cook on board to take care of the vessel, which is hove to, not anchored. This fishing is in such deep water—ten to twenty fathoms—that very heavy leads and stout lines are used. One very soon learns that this is no pastime. Usually two hooks are attached, and, after baiting with salted clam, the line is "reeled off" by the weight of the "sinker." It strikes bottom with a thud. You haven't even the luxury of a "bite," or not one to feel or speak of. Ordinarily, when fishing is lively, you begin to haul up without reference to probabilities, and when the line is well nigh in board a new sensation, as that of resistance, and an increasing sense of weight, assures you of the fact that one or two large Cod-fish or Haddock are attached to the line. The hauling in of the line and lead is nearly as fatiguing as the same process with Fishes attached. The enormous boots, made especially heavy by adding very thick soles, are seen to be of great service to those who fish from the "dorys," as these boats are very light, and the heavy boots serve to steady one as the sea tosses them. The Cod-fish is supposed to range from the Polar regions to Hatteras. Gadus ojac—THE GREENLAND COD-FISH, OJAC or OVAK of the natives of Greenland—is found only in the Polar regions. Baird records this as a doubtful species.

TOMCOD (*Microgadus tomcodus* (*Walb.*), *Gill.*)—This Fish was described by Mitchill as Morrhua tomcodus, and though the specific name is, as Storer intimates, scarcely scientific, it is retained. It is called in some quarters FROST-FISH. In the vicinity of Boston and eastward to Maine it appears with the Smelt, being caught readily with hook from the wharves. DeKay says: "It is found on our coast during the whole year; but in autumn, after the first frost, it becomes very abundant. Hence its name, FROST-COD or FROST-FISH. It is a savory Fish, and is caught in great numbers. I have known them to be taken out of the water along the shores of Long Island in great numbers with a common garden hoe. They ascend rivers, even into fresh water." The range of the TOMCOD is from Newfoundland to Hatteras, although, like some other species, it is seen in much greater perfection and size in the colder waters of Maine and northwards. Around Boston this Fish is scarcely accounted worth taking, being so small, though Dr. Storer records that formerly it was taken in great numbers in Charles River for the Boston market; but in Casco Bay it reaches about twelve inches in length, and is there considered excellent food.

THE HADDOCK (*Melanogrammus æglefinus* (*Linn.*), *Gill*).—Gadus of Linnæus. This is the most valued Fish, after the Cod, which inhabits our waters. Immense shoals of Haddock are seen in the spring-time, and continue near the shore until autumn, when they retire to deeper water. Its flesh is excellent, and its extreme cheapness affords the poorer classes a most desirable food. The following remarks of Mr. Atwood, of Provincetown, before the Legislature of Massachusetts, in 1870, show how this Fish has increased on our coast: "When I first engaged in the fisheries, Haddock was scarce on our coast, and in winter sold much higher than Cod. They did not increase for many years after. They became more plentiful in 1850, when the trawl-line was first used, and every year they seemed to be increasing. On the fourth of last March (1870), when a large number of fishing boats were out, the catch was larger than I ever knew before. The next day (5th) there was brought to this city (Boston) and sold, of Cod and Haddock, 621,953 pounds, as taken from the books of dealers that day." The Haddock is said to spawn from the last of October to December. The range is from Newfoundland to Hatteras.

CODLING (*Phycis chuss* (*Walb.*), *Gill*).—Called OLD ENGLISH HAKE and SQUIRREL HAKE in Massachusetts; LING and CHUSS in New York. Storer records it as AMERICAN HAKE (P. americanus). Great numbers of Hake are taken in Massachusetts Bay. A favorite place for the fishermen of Lynn and Nahant is off the latter place, where, during the nights of summer, they are caught with hooks. The Hake varies from three to thirty pounds in weight, and reaches three feet in length. P. tennis—called WHITE HAKE in Massachusetts and SQUIRREL HAKE in Maine—has the same range as the preceding.

SPOTTED CODLING (*Urophycis regius* (*Walb.*), *Gill*).—Called SPOTTED COD (Gadus punctatus) by Mitchill, and SPOTTED PHYCIS by Richardson. This is regarded by DeKay as an exceedingly rare but distinct species, occurring from the coast of New York to the Gulf of St. Lawrence. Baird records it as ranging from Cape Cod to Cape Hatteras.

LING (*Molga vulgaris, Flem.*)—IVERKSOAK of the Greenlanders, is found in the Polar regions.

FIVE-BEARDED ROCKLING (*Onos reinhardtii* (*Kroyer*), *Gill*).—Inhabits the waters of Greenland. THREE-BEARDED ROCKLING (O. ensis) is from the same region. FOUR-BEARDED ROCKLING (Rhinonemus caudacuta (Storer), Gill) is recorded as a doubtful species. Habitat from Nova Scotia to Cape Cod.

MACKEREL MIDGE (*Ciliata argentata* (*Reinh.*), *Gill*).—Ranges from Greenland to Hatteras.

EUROPEAN CUSK (*Brosmius brosme* (*Fab.*), *White*).—This is regarded as a doubtful species, found from Nova Scotia to Cape Cod. It is called TORSK in Great Britain, and PALLUJAK in Greenland. Brosmius flavescens (Lesueur) is also called CUSK, though marked doubtful as to species by Baird. This is the Cusk (B. vulgaris, Cuvier) of *Storer's Report*, and Yellow Tusk of Richardson and is found on the banks of Newfoundland.

FAMILY—MERLUCIIDÆ.

EUROPEAN HAKE (*Merlucius vulgaris, Flem.*)—This is recorded as doubtful as to species, or its identity with others. Baird gives the habitat as Greenland. Under the head of The Hake, (M. vulgaris), Storer records a species, which is generally known as WHITING by the fishermen of Massachusetts. He remarks that it is really the European Hake, and is not taken in large quantities in our waters. It is, when perfectly fresh, very sweet and palatable, but becomes soft so soon that it is kept with great difficulty. DeKay records as synonyms: The American Hake (M. albidus), and The New York Whiting (Gadus albidus, Mitchill). He says: "This is a rare Fish in New York waters, and, when caught, is always associated with the Cod." Smith says: "The best are taken off Cape Cod, and sold under the name of *Stock-fish*. When prepared for the market they are called *Poor Johns*." Another is recorded by Baird (M. bilinearis (Mitch.), Gill), called AMERICAN HAKE, SILVER HAKE in Maine, and WHITING in Massachusetts. Found from Nova Scotia to Hatteras.

FAMILY—OPHIDIIDÆ.

LITTLE CUSK OF NEW YORK (*Ophidium marginatum, Mitch.*)—DeKay says: "This very rare and curious species was taken in a seine in New York Harbor in company with a shoal of Striped Bass. It has so much the habits of some of the *Gadidæ*, especially the Brotula, that our fishermen call it LITTLE CUSK."

FAMILY—BROTULIDÆ.

Bythites fuscus (*Reinhardt*).—Habitat, Greenland This is the one genus and one species belonging to this family which is found in our waters.

FAMILY—LYCODIDÆ.

The genus Gymnelis, species viridis (Reinhardt), is from the Polar regions.

VAHL'S LYCODES (*Lycodes vahli, Reinh.*) is found in Greenland waters. Other species of Lycodes recorded are: L. reticulatus, Reinh.; L. perspicillum, Kroyer (SPOTTED LYCODES); L. seminudus, Reinh.; L. nebulosus, Kroyer (CLOUDY LYCODES); L. mucosus, Rich. (SLIMY LYCODES), and L. polaris (Sabine), Rich. (ARCTIC LYCODES); all from Greenland waters.

CONGER EEL (*Zoarces anguillaris* (*Peck*), *Storer*).—Called, also, EEL-POUT and LAMPER EEL. Is found from Newfoundland to Hatteras. DeKay records this as THICK-LIPPED EEL-POUT, and Storer as the EEL-SHAPED BLENNY. The latter says: "This species sometimes attains a size of three and a half feet. It is seldom met with in the Boston market. When young its flesh is very sweet and palatable." This Fish feeds on various marine shells, and affords a very savory food. According to Cuvier it has one hundred and thirty-seven vertebræ.

FAMILY—CRYPTACANTHIDÆ.

GHOST-FISH (*Cryptacanthodes maculatus, Storer*).—Called, also, WRY-MOUTH. Found from Nova Scotia to Cape Cod. Dr. Storer, who first noticed this Fish, says the first specimen met with was said to have been taken in Boston Harbor, and measured about twenty-one inches long. Another was taken at Nahant. A third was taken from the stomach of a Haddock. Its generic name is selected to express the presence of a concealed spine, the operculum and other adjacent parts having numerous spine-like points. DeKay calls it SPOTTED WRY-MOUTH, and says it is a very curious and rare species. A species (C. inornatus)—called, also, SHORT-FISH, and in Maine, CONGER EEL—has the same range.

FAMILY—STICHÆIDÆ.

LITTLE CUSK (*Eumesogrammus subbifurcatus* (*Storer*), *Gill*).—So called in Maine. Its habitat is from Nova Scotia to Cape Cod. Another species—E. præcisus (Kroyer), Gill—is found in Greenland. The following species of this family are from the Greenland waters: Stichæus punctatus (Fab.), Reinh.; Leptoclinus aculeatus (Reinh.), Gill.; Anisarchus medius (Reinh.), Gill; Lumpinus fabrici, Reinh.; Leptoblennius gracilis (Stuvitz), Gill; Centroblennius nubilus (Rich.), Gill. Leptoblennius serpentinus (Storer), Gill, is described and figured by Storer, who first noticed it from a specimen sent him from Cape Cod. It is called by him SNAKE-SHAPED BLENNY (Blennius serpentinus).

FAMILY—XIPHIDIONTIDÆ.

BANDED BUTTER-FISH (*Muræoides fasciatus* (*Schneider*), *Gill*).—Inhabits Greenland waters.

COMMON BUTTER-FISH (*M. mucronatus* (*Mitch.*), *Gill*).—This is found from Nova Scotia to Hatteras. Gill marks it as a doubtful species. Under the head SPINOUS OPHIDIUM (Ophidium mucronatum), Mitchill describes and figures this species, which he says was caught in the salt-water at Brooklyn. Storer figures it as Butter-fish (Gunnellus), and says it is common at Nahant and southward to Holmes' Hole, and probably along the entire coast. It is found at low tide beneath the stones, and is with difficulty held in the hand on account of the extraordinary amount of mucus which covers it; hence the name. DeKay calls it the American Butter-fish.

THE BIG-HEADED GUNNEL (*M. macrocephalus* (*Gir.*), *Gill*).—This is marked by Gill as doubtful. Storer says the specimen from which he took the description was taken alive by Mr. Girard from a sand pool on Chelsea Beach at low tide. M. ingens (Storer), Gill, is a doubtful species found in Labrador. Asternopteryx gunnelliformis, Ruppell, is recorded by Dr. Gill as Greenland (?).

FAMILY—ANARRHICHADIDÆ.

WOLF-FISH (*Anarrhichus vomerinus* (*Ag.*), *Storer*).—Marked doubtful species. Called CAT-FISH in New England, and KIGUTILIK in Greenland. Mitchill calls it SEA-WOLF (A. lupus), and remarks: "No use seems to be made of them, notwithstanding the vast numbers taken. Yet it is reputed as good food. The Greenlanders eat it fresh, and also as a dried fish." We were impressed with the enormous waste of this Fish which formerly occurred at the fishing-beaches near Boston, and determined to set the example of using the Cat-fish—as the species is called there—for food. Its flesh is so white and sweet, being somewhat like that of the Cod, there seemed to be no reasonable excuse for rejecting it. Our experience induced some of the fish-hawkers of Swampscott to retail it in the streets of Lynn and Salem, where it has since been regularly served. Storer says: "It is a ferocious Fish, weighing from five to twenty-five pounds, captured about the rocky ledges at all seasons of the year, though greater numbers are taken in winter than at other times." DeKay says: "It prefers rocky coasts, and is said to spawn in May. They are not unfrequently taken off Rockaway Beach, in company with the Common Cod. In high latitudes it attains the length of eight feet." According to Richardson, the Common Sea-wolf "inhabits the North Sea, being common enough as low as the French coast. On the Greenland coast it is associated with the Common Lumpfish, migrating along with it. It spawns in May in the larger sea-weeds, a short way from shore." A. steenstrupi (Gill), and A. denticulatus (Small-toothed Wolf-fish), are found in Greenland waters.

FAMILY—BLENNIIDÆ.

The Blennies were known to Pliny, and Artedi introduces the generic term Blennius, which, by an extended signification, has a Greek derivation, meaning *mucus*, from the "soft and indolent character of the Fish." The remarkable secretion of mucus from their bodies is characteristic. The males are decorated with soft papillæ, which are absent in the females.

SEA-WEED BLENNY (*Blennius fucorum, Cuv. and Val.*)—This is indicated as doubtful, both as to genera and species. Another, named B. geminatus, Wood, is also marked doubtful. The habitat of both is given as South Carolina. DeKay found one of the former in a drift of sea-weed just off shore near New York. THE SPOTTED BLENNY (Hypleurochelus punctatus (Wood), Gill), is found on the coast from Cape Hatteras to Florida. CAROLINA BLENNY (Pholis carolinus, Val.), inhabits the waters south of Hatteras. HENTZ'S BLENNY (Hypsoblennius hentzi (Lesueur), Gill), from Hatteras to the Carolinas. Bosc's SHANNY (Chasmodes bosc ianus (Lac.), Cuv. and Val.), from New York to Florida. THE NINE-LINED SHANNY (C. novemlineatus, Val.), and the FOUR-BANDED SHANNY (C. quadrifasciatus, Val.), are from the same locality.

FAMILY—BATRACHIDÆ.

THE TOAD FISH (*Batrachus tau, Linn*).—This curious Fish is so named, specifically, by Linnæus from the fact that when dried the skin on the head represents by two elevated lines the Greek letter *Tau*. It is found in localities along our whole coast, where Eel-grass is abundant. Storer gives an interesting account of the nesting of this Fish. It seems to excavate a space beneath stones, wherein the eggs are deposited, on the under surface of them. When the eggs are hatched, the young become attached to the stones by a small disc, which seems to be a part of the yolk bag. Here the young remain until they are able to shift for themselves, guarded vigilantly by the senior Toad-fish.

FAMILY—URANOSCOPIDÆ.

Belon has a chapter on the Fish which gives name to this family, with a very good figure, which is also called Blennus.

THE NAKED STAR-GAZER (*Astroscopus anoplus* (*Cuv. and Val.*), *Brevoort*).—Habitat, New York to Florida. DeKay figures this as the UNARMED STAR-GAZER (Uranoscopus anoplus).

FAMILY—CYCLOPTERIDÆ.

LUMP-FISH (*Cyclopterus lumpus, Linn.*)—Called, also, LUMP-SUCKER, SEA-OWL, PADDLE. Inhabits from the Polar regions to Cape Hatteras. Mitchill describes it as C. ceruleus (BLUE LUMP-FISH), and DeKay as Lumpus anglorum, retaining Willoughby's name. This singular Fish, which is sometimes found weighing seventeen pounds, is not eaten in this country. Its ventral fins are cup-shaped, and serve to produce a powerful suction when flattened upon any object. THE SPINOUS LUMP-FISH (Eumicrotremus spinosus), is a northern species found from Greenland to the Bay of Fundy.

FAMILY—LIPARIDIDÆ.

SEA-SNAIL (*Liparis lineata* (*Lepechin*), *Kroyer*)—Called the LINEATED LIPARIS. Its range of habitat is from the Polar regions to Cape Cod. MONTAGU'S LIPARIS (L. montagni), has the same range. L. arctica and L. fabrici are found only in Greenland waters. LARGE LIPARIS (Actinochir major (Walb.), Gill, and REINHARDT'S LIPARIS (Careproctus reinhardti, Kroyer), are also confined to the coast of Greenland.

FAMILY—GOBIIDÆ.

This family derives its name from *Gobio*, a term used by an old Latin author, meaning simply "a kind of gudgeon," the latter from the French *goujon*, "a small fresh-water Fish." The Gobies all bear a strong resemblance to each other; are notable in not having air-bladders; are small in size and frequent the rocky beds of the sea-shore. Many species are viviparous. In Cuvier's arrangement there are over three hundred species, of which eighteen are said to inhabit American waters. Those common to both sides of the Atlantic are the species found in the Greenland seas. One, according to Capt. Ross, the explorer, is the most northern known Fish, having been taken on the ice north of Spitzbergen, within nine degrees of the Pole. Recent arrangement of Fishes exhibits in this family the following as American:

SCALELESS GOBY (*Gobiosoma alepidota* (*Lac.*), *Girard*).—Found from Cape Cod to Florida. DeKay records this as THE VARIEGATED GOBY (Gobius), found rarely in the harbor of New York. Mitchill calls it G. viridipallidus. BLACK GOBY (G. carolinensis, Gill), and STRIPED SLEEPER (Dormitator lineatus, Gill), are found from Cape Hatteras to Florida.

FAMILY—TRIGLIDÆ.

FLYING ROBIN (*Dactylopterus volitans* (*Linn.*), *Lac.*)—Also called SEA-SWALLOW; in Cuba, MURCIELAGO; in Bermuda, BAT-FISH. In *Shaw's Zoölogy* it is called FLYING GUMARD (Trigla volitans). This species is said to spring into the air by aid of its immense pectoral fins, and to sustain itself in the manner of Flying-fishes for a short time. Found from Newfoundland to Florida.

LINED SEA-ROBIN (*Prionotus evolans* (*Linn.*), *Gill*).—Found from Cape Cod to Florida. Called in New Jersey FLYING-FISH.

SPOTTED SEA-ROBIN (*P. punctatus* (*Bloch*), *Cuv.*)—RUBIO VOLADOR, in Cuba. Habitat, Florida.

WEB-FINGERED SEA-ROBIN (*P. carolinus* (*Linn.*), *Cuv. and Val.*)—Called, also, the CAROLINA ROBIN. Inhabits from Cape Cod to Florida. This is WEB-FINGERED GURNARD of DeKay, who regards it as a very rare Fish—a southern species, but found at Nantucket. Storer calls it P. palmipes. Mitchill has described it in *Fishes of New York*. Just in front of and beneath the pectoral fins are three fleshy appendages which are club-shaped and curved; these are used when the Fish is in contact with the rocks, and have the appearance of being used for locomotion. We have seen this species in considerable numbers in the New York Aquarium, which were probably taken at Vineyard Sound. These Gurnards were frequently seen to crawl over the

rocky sides of the tank, using the pectoral appendages precisely as a Crustacean walks. They are said to cover themselves with sand.

SMALL-SCALED SEA-ROBIN (*P. pilatus, Storer*).—Inhabits the waters on the coast of Massachusetts; is very rare, and regarded as a doubtful species. THE EUROPEAN GURNARD (Trigla cuculus, Linn.), is found on this coast only accidentally.

FAMILY—AGONIDÆ.

THE ASPIDOPHORE (*Aspidophoroides monopterygius* (*Bloch*), *Storer*).—Inhabits from the Polar regions to Cape Cod. This is also called the BULL-HEAD. DeKay says it is very rare. Storer received several, taken from the stomachs of Cod caught in Massachusetts Bay. The generic name indicates *shield-bearer*, referring to the armor-like anterior. SEA-POACHER (Agonus cataphractus, Linn), inhabits the Polar regions. Another of this family—the Archagonus decagonus, Gill—is also found there.

FAMILY—COTTIDÆ.

The Sculpins are embraced in this family. The term *cottus* is said to be derived from the Greek *kottos*, a head. The word *Sculpin* may have a similar derivation, as the head of these Fishes is angular and skeleton-like. This family is represented both in salt and fresh-water. There are about twenty genera and seventy species, mostly in northern waters. All of this group are especially uncouth in appearance. The cheeks are mailed—that is, the suborbital bone extends backward over the cheeks, articulating with the preopercle. The head is extremely broad and large, usually beset with spines. The eyes are situated high upon the head. The body is in many instances naked, not covered by scales. The air-bladder is usually absent.

SLENDER SCULPIN (*Cottus octodecemspinosus, Mitchill*).—In Mitchill's work this is called EIGHTEEN-SPINED BULL-HEAD and PIG-FISH, from the squeaking noise it makes immediately on being taken out of water. DeKay records it as THE COMMON BULL-HEAD (Cottus virginianus); Storer, THE COMMON SCULPIN. DeKay suggests that Sculpin is from Scorpion. It is known as SEA-ROBIN and SEA-TOAD. In Massachusetts, near Boston, it is often called GRUBBY. Its habitat is from Nova Scotia to Cape Hatteras. This is a very familiar Fish with boys, and those who fish from the wharves or rocks in our eastern harbors. It is not eaten, and its capture is regarded as an unmistakable evidence of the unskillfulness of the fisherman, it being a "ground-fish," prowling near the bottom, where no true angler is supposed to cast a line.

LITTLE SCULPIN (*Cottus æneus, Mitchill*).—Called by Mitchill, BRAZEN BULL-HEAD, and described as having brass-colored complexion, thorny head, and rusty blotches over the sides. DeKay says it is frequently taken by the hook in Long Island Sound and the harbor of New York. It is about five inches long, and ranges from Cape Cod to Hatteras.

NORTHERN SCULPIN (*C. grœnlandicus, Cuv. and Val.*)—This is marked doubtful as to species. DeKay records it GREENLAND BULL-HEAD (C. grœnlandicus). Storer calls it "THE GREENLAND SCULPIN (Acanthocottus variabilis, Girard); a beautiful Fish, much less common than C. virginianus." The following are recorded as "varieties (?)": Cottus porosus (Val. and Cuv.), Baffin's Bay; C. occellatus, (H. R. Storer), Greenland to Newfoundland; C. labradoricus (H. R. Storer); C. glacialis (Rich.), Greenland; C. pachypus (Günther), Greenland; C. mitchilli (Cuv. and Val.), Newfoundland to Hatteras. C. scorpioides (Fab.), Greenland; Symnacanthus tricuspis (Reinh.), Gill; S. patris (H. R. Storer), Gill; Oncocottus quadricornis (Linn.), Gill; Icelus bicornis (Reinh.); I. uncinatus (Reinh.); Cottus polaris (sabine); Triglops pingeli (Reinh.); T. pleurostictus (Cope); all the latter from Greenland.

FAMILY—HEMITRIPTERIDÆ.

SEA-RAVEN (*Hemitripterus acadianus* (*Walbaum*), *Storer*). — Called, also, YELLOW SCULPIN. Inhabits from Newfoundland to Cape Hatteras. DeKay calls this species AMERICAN SEA-RAVEN (H. americanus), and says it is known among the fishermen as SEA-SCULPIN. Mitchill described it as YELLOW SCORPENA (Scorpena flava). Pennant calls it ACADIAN BULL-HEAD. Storer records it as DEEP-WATER SCULPIN, and remarks that it is frequently taken by the Cod-fishermen, in deep water, in the neighborhood of ledges in Massachusetts Bay.

FAMILY—SCORPÆNIDÆ.

PIG-FOOT (*Scorpœna porcus, Linn.*)—This is regarded as a European species, accidental in New York waters. DeKay says: "It is one of the few Fishes that cross the Atlantic." Scorpœna plumeri is found in the West Indies, and occasionally on our north-eastern coast.

NORWAY HADDOCK (*Sebastes norvegicus* (*Linn.*), *Cuv.*)—Called HEMDURGAN by the fishermen of the eastern coast, and BERGYLT in other places. It also has the names ROSE-FISH and SNAPPER. DeKay says: "This is a very rare Fish in our waters. It is called by our fishermen Red Sea Perch." The color is a brilliant scarlet over the entire body, and its shape is exceedingly comely. Sebastes viviparus (Kroyer), and S. fasciatus, are recorded as other species. These are marked as doubtful both as to species and genus.

FAMILY—LABRIDÆ.

This family derives its name from *Labrus*, described by Pliny as a "ravenous Sea-fish."

TAUTOG (*Tautoga onitis* (*Linn.*), *Gunth.*)—Called, also, BLACK-FISH. Mitchill describes this Fish as "BLACK-FISH OF NEW YORK," and "TAUTOG OF THE MOHEGANS," also TIDE BLACK-FISH OR RUNNER. He says: "The Black-fish abounds in the vicinity of Long Island, and he is a stationary inhabitant of the salt-water. He is fond of rock, reef, and rough bottom. * * The Tautog was not originally known

in Massachusetts Bay, but within a few years he has been carried beyond Cape Cod, and has multiplied so abundantly that the Boston market has now a full supply without the necessity of importing from Providence and Newport. He is considered by New Yorkers as an excellent Fish for the table. He grows to the weight of ten or twelve pounds. * * The blossoming of the Dogwood (Cornus florida) early in April, or of the Chestnut trees, is understood to denote the time of baiting Black-fish.

> "'When chestnut leaves are big as thumb nail,
> Then bite Black-fish without fail;
> But when chestnut leaves are long as a span,
> Then catch Black-fish, if you can.'"

Mitchill advises the proper bait, as the Soft-clam and the Fiddler-crab. He says: "Some persons who live in the neighborhood of the shores where are situated the rocks frequented by Black-fish, invite the Fish there by baiting. By this is meant the throwing overboard broken clams, etc., to induce the Black-fish to renew their visits; and fine sport is procured." Then the manner of fixing the localities by "marks" on shore, whereby the "range" is found of celebrated "fishing grounds." He says: "Great stillness is to be observed, as Black-fish can hear very well. He is a strong Fish, and pulls well for one of his weight and size." Certain occurrences are found to interfere with this sport. "The appearance of a Porpus infallibly puts an end to it." Dr. Mitchill first named this Fish from the Indian (Mohegan) designation, which is Tautog—supposed to mean *black*. In his first report it was called T. niger. Dr. DeKay regards it as savory Fish, affording equal pleasure to the epicure and angler. Its usual weight is about two pounds. The largest he had seen weighed twelve pounds. Dr. Storer states that one was taken off one of the bridges in Boston which weighed eleven and three-quarter pounds; and the largest of which he had any accurate knowledge weighed sixteen pounds. He is wary and bites well, and is very tenacious of life. He takes the hook from April to autumn, and thereafter is only found in deep water. The geographical range of this Fish is quite limited. Gen. Pinckney, of South Carolina, introduced a smack load of them into Charleston Harbor, some years since, and they were yet to be found there in 1842. Though this Fish has been introduced into Massachusetts Bay, yet, according to Dr. Storer, in 1867, it was supplied to New York market from Billingsgate Point, in Wellfleet, Cape Cod. Dr. J. V. C. Smith says: "Within the recollection of gentlemen now living (1833), the Tautog was unknown in Boston Harbor. A subscription was successfully undertaken for bringing them alive in cars, from Newport, R. I., which were supposed the first of the species which had ever been to the eastward of Cape Cod." The history of this Fish is interesting. "The Tautog," says Gill, "is related to the Wrasses of Europe, but is the only member of its genus. It is common on the Atlantic coast, from Massachusetts to Carolina, but is rarer further northward and southward. It makes its appearance in large numbers, and in shallow waters on the New England and New York coasts, between April and November, and is most abundant in May and October. It is then, on some parts of the coast, the most abundant of the larger Fishes, and is a staple market Fish. It spawns in May or June, depositing its eggs in weedy places or among the Eel-grass." It will be seen, then, that this Fish, though a peculiarly American and surprisingly local one, being greatly circumscribed in its habitat, has increased and enlarged its field or geographical range, and become an important item commercially, as well as a valuable addition to the possibilities of the gentle angler. In 1850 we occasionally fished for it off the rocky shores of Swampscott and Nahant, and then it was, as elsewhere, along shore above Cape Cod, rather exceptional to procure more than a "few bites." These shores are peculiarly suited to the habits of the Tautog, as well as the Conner, as the multitude of rocks break the sea as it rolls in continually, causing the rapid movement of water that delights our finny prey. The range of this Fish is now recorded as from the Bay of Fundy to Carolina.

NIPPER; CONNER; CHOGSET (*Tautogolabrus adspersus* (*Walb.*), *Gill*).—We place at the head of this article the familiar designation that many Essex County boys will quickly recognize. No author save Dr. Smith has preserved this trivial name. Dr. Storer ignores it; indeed, the name is never heard in Boston, though the Fish is caught in great numbers around the harbor and at the bridges. It is there called CONNER. Yet, at Nahant, where many Bostonians "summer," this Fish is invariably called NIPPER. In Marblehead, four miles eastward, on the continuous line of coast, it is called *Cunner*, a corruption of *Conner*. In Salem Harbor it is known as CHOGSET and PERCH. The terms BERGALL, BLUE-PERCH and BLUE-FISH are applied in other quarters west of Boston; the first is a New York appellation from the Dutch. Chogset is the Indian name. Around Nahant and the shores between Boston and Cape Ann, this Fish is particularly prized. From the first settlement of the country it has been customary for parties to repair, during the warmer months, for a few hours or days, to these shores, notably Nahant, for the purpose of enjoying the pleasures of "nippering." The inhabitants of Lowell, and even of the manufacturing towns of New Hampshire, whose coast line is exceedingly limited, resort here in "wagon loads." Formerly, these parties went fully equipped with poles and lines, and with an assortment of utensils for cooking Fish. At these occasions a tent was pitched on the east side, at Tudor's Spring, or on the west, at Bass Point. Here the excellent cold springs of water that were at hand in the bold head-land rocks afforded a convenient element for cooking, and a delightful beverage during the excessive heats of the summer time. The Nippers were taken by hook from the rocks in abundance by the skilled angler, and to him this is indeed a real pastime, for the little Sea Perch or Nipper is game, and fights strongly. Dr. Smith correctly puts it when he says: "This Fish is probably better developed in Boston than at the south of the Cape, the water being colder and salter." We have seen

that the little Tomcod, which in Boston waters is too small to be of much account, is in Maine waters quite a desirable Fish and much better flavored. It seems that some Fishes are larger and better in flesh as eatables the farther north they are found, and the Conner is one. Those taken at Casco Bay are nearly equal in size to the common run of Tautog around Nahant. DeKay records this species as Ctenolabrus ceruleus, and Storer as Crenilabrus bergall. Its range is from Newfoundland to Cape Hatteras.

RAZOR-FISH (*Xyrichthys lineatus* (*Gmel.*), *Cuv. and Val.*)—This is a West Indian species, and an occasional visitor on our Southern coast. Chœrojulis grandisquamis, Gill, is a species of this family found in the waters around North Carolina coast.

FAMILY—TEUTHIDIDÆ.

SURGEON-FISH (*Acanthurus chirurgus, Bloch and Schneider*)—Plate X, fig. ii.—Called BARBERO in Cuba, and DOCTOR-FISH in Bermuda. The illustration of this Fish shows on the side of the narrow keel-like portion which unites the tail to the body, a triangular blade, which is capable of opening and closing like the blade of a knife or lancet. This peculiar apparatus is used by the Fish for defense or offense as occasion requires. We have kept this Fish in a large aquarium situated in the waters of the harbor at Fort Jefferson, Tortugas, on the Florida Reef. Unlike many Fishes, it was easily kept alive, and its pugnacity and courage seemed commensurate with its known powers of defense. It did not hesitate to expose itself to any danger, and when approached in any shape it was ready to defend itself by a side thrust of its weapon. It measures from six to ten inches long. Habitat, West Indies and northward. DeKay records it as A. phlebotomus.

BLACK SURGEON (*A. nigricans, Linn.*)—This is a West Indian species, occasionally found northward.

FAMILY—CHÆTODONTIDÆ.

This family derives its name from the word *Chæte* —hair—the typical forms having hair-like teeth. It includes some of the most remarkable shapes and the most brilliantly and grotesquely colored of Fishes. On the Florida Reef great numbers are known.

ANGEL-FISH (*Holacanthus ciliaris, Lac.*) — This very beautiful Fish is only occasional with us, as it is a West Indian species; common, also, in Bermuda waters. In Cuba it is named ISABELITA. This Fish has been very successfully kept in the New York Aquarium. Sarcothrodus maculocinctus, Gill, is another genus, found from Cape Cod to Cape Hatteras.

FAMILY—XIPHIDÆ.

This family includes the typical Sword-fish, Xiphias, treated by Pliny, Rondelet, Belon and other ancients. Three genera, with as many species, are found in our waters.

COMMON SWORD-FISH (*Xiphias gladius, Linn.*)—Plate 10, fig. 53.—This Fish was well known in the time of Pliny, who associates it with several others as "suitable to use as salted Fish." He includes with this, "Elcatena, a Fish like the Tunny." Rondelet describes it under the names "*Du Poisson nommé Empereur;* Greek, *Xiphias;* Latin, *Gladius;* in Italy, *Pesce spada.*" Belon says: "In France it is named *Heron de Mer* and *Poisson Empereur.*" Strabo describes the Sword Fishery, and regards it as ancient as Ulysses. DeKay mentions a Sword-fish sixteen feet long, taken off Sandy Hook, and also says: "The markets were well stored with the flesh of this Fish. It is preferred to Sturgeon and Halibut, which in flavor it somewhat resembles." Storer says it is seldom seen in Massachusetts Bay, but is a common Fish at some seasons from Block Island to Nantucket. We have seen it rather common off Casco Bay, near Portland. The fishing vessels there are provided in the season with resting bars on the bowsprit, and the lance is always at hand, ready for immediate use, hung in the rigging of the jib-stay. During a sojourn at Peake's Island we often had Sword-fish for food, and much preferred it to Halibut. It seemed to possess the good qualities of the latter Fish and Blue-fish. The Sword-fish is usually seen swimming along the surface like a Shark, its high dorsal fin exposed. It is then seeking shoals of Mackerel, upon which it feeds. It is sometimes taken with a hook, but is usually captured by striking with the "lily-iron." It has the habit of springing forward, out of water, like the Dolphins. At Martha's Vineyard a regular fishery is kept up for them, and a large portion is salted for market. The largest individuals are said to weigh about three hundred and fifty pounds. The peculiar weapon which gives name to this Fish is a prolongation of the upper jaw or snout. Its use is not clearly understood, though upon occasion it proves a most formidable weapon. An instance occurred of a pilot boat in Boston Bay being penetrated by one. Several instances are extant of ship bottoms being punctured, and the sword left broken and embedded, to testify to the wonderful power of the creature. Sir Joseph Banks records an example where the sword was driven its entire length into the solid wood of a ship. On the coast of Brazil this Fish is said to attain the length of twenty-five feet. It is one of the few that cross the Atlantic, being the same as that inhabiting the Mediterranean Sea.

BILL-FISH (*Tetrapturus albidus*). — Called, also, the SPEAR-FISH. This is common along the coast from the West Indies to Nova Scotia. It is recorded by DeKay as Scomberesox storeri, and figured. Leseur calls it S. equirostrum. This Fish is seen on the Massachusetts coast during October in great numbers, where it is used as food. It is rare on the coast of New York.

THE SAIL FISH (*Histiophorus gladius* (*Brouss.*), *Gunth.*) — Called, also, SAILOR-FISH and SAILOR SWORD-FISH. A species found in the Mediterranean Sea has an enormous spread of dorsal fin which resembles a fan or sail; hence the name. The tail is also extremely deep and slender. An excellent figure, in wood, is in the *Historiæ Rerum Naturalium*

Brasiliæ, by Geo. Marcgravi, 1648, with descriptive account of the species. He calls it GUEBUCU and BICUDA. It ranges from Cape Cod to the West Indies.

FAMILY—TRICHIURIDÆ.

SILVERY HAIR-TAIL (*Trichiurus lepturus, Linn*)—This Fish was described by Mitchill as T. argenteus, with the under jaw jutting beyond the upper, and a snake-like tail. Its length was two feet and four inches. There is a specimen in Scudder's Museum that is alleged to have been swallowed by a Mackerel. This species is known among the fishermen as RIBBON-FISH.

FAMILY—SCOMBRIDÆ.

This family includes very many important forms, and those which frequent the high seas especially. They are notably strong and fast swimmers. The Tunnies and Mackerels go in large schools, and are objects of great interest to our fishermen. The resemblance is remarkably great among even those like the Mackerel, a small Fish, and the Tunny, which weighs over a thousand pounds; the latter looks like a gigantic Mackerel, though not so slender. Some are in the habit of wandering through distant seas. On one occasion a shoal of small Tunnies came to the coast of Massachusetts, and it was found that the species was entirely unknown there, being a familiar one in the Mediterranean Sea.

THE MACKEREL (*Scomber scombrus, Linn.*)—This is the typical form, and the familiar and best esteemed Fish of our coast. Trumbull records its Narragansett Indian name as WAWWHUNNEKESUOG. In Cuba it is called CABALLA. Its habitat range is from Greenland to Hatteras. A form, called Maquerlan, is figured well in Rondelet, who gives as the Latin name, *Scomber*, or *Scombrus*. Belon figures *Le Maccreau*, and gives the name used at Marseilles as *Horreau*. Among the products of this fish known to the ancients, is the peculiar sauce called *garum*, which is said to be still used by the Turks. Storer remarks: "The Mackerels appear from tenth of May to fifteenth of June at the entrance of Massachusetts Bay, having been a few days previous at Nantucket and Martha's Vineyard. Nine-tenths of those which are first seen are males, and they are all large and poor, weighing one to one and a half pounds. At their first appearance they will not take the hook, and are therefore captured in nets." These are "gill nets," which are hung in the water vertically, and the Fishes are caught by trying to pass through, being entangled by the gills. During the season for catching Mackerel, when large schools are seen upon the surface of the sea, it is an interesting sight to witness their capture by the skilled fishermen. The bait consists of menhaden, ground in a mill kept on the deck for the purpose; this is thrown out to entice the Mackerel schools within reaching distance. When the school surrounds the vessel, the men use short lines with a single hook, the latter embedded in a tin "sinker." Barrels are placed at hand, and the operation of capture is often so quickly performed that the men are occupied in a constant throwing out and jerking in of their lines, which are so short that they have only to reach the surface when the Fishes are crowding each other to reach the bait, and in some instances are actually scooped in board. The hook is readily separated from the tender mouth as the Fish is thrown into the barrel, and as no bait is used, the Fishes snapping at such times at the bright tin sinker, the operation is one of toss out and toss in, with as much rapidity as one can count *one, two; one, two.*

CHUB MACKEREL (*Scomber colias, Linn.*)—Called, also, THIMBLE-EYE or BULL-EYED MACKEREL and FALL MACKEREL by DeKay. Storer describes this as the same as his Spring Mackerel (Scomber vernalis). DeKay says: "In the autumnal months it appears in great numbers on our coast, and is scarcely distinguishable from the preceding species." Its range is from Nova Scotia to Cape Hatteras.

BONITO (*Sarda pelamys* (*Linn.*), *Cuv.*)—Called SKIP-JACK. Ranges from Cape Cod to Florida. The Bonito is described and well figured by Rondelet, who names it *Boniton*, and gives the Greek name, *Amia*, which is used also for the Tunny. Its Spanish name is *Biza*. DeKay describes it as the Striped Bonito, and an occasional visitor on the New York coast. Storer records it as the same, and adds that it is very rarely met with in Massachusetts Bay.

THE HORSE MACKEREL (*Orcynus secundo-dorsalis* (*Storer*), *Gill*).—This is recorded as a doubtful species. In Rhode Island and by some of the more northern fishermen, it is called ALBICORE, and also AMERICAN TUNNY. Its range is from Newfoundland to Florida. Rondelet figures a Tunny under the name *Thon*, and another species which he calls *Pelamyde*, or *Thon d'Aristote*. The first he denominates in Greek as *Orkunos*, which he says is the "grand Thon." The generic name now used is evidently from the old Greek designation, and Tunny is from *Thynnos*, the more common term in use among the ancients. This Fish seems to have been very well known to the people living on the shores of the Mediterranean Sea, as it is largely treated by ancient writers. Rondelet figures a Bize, which he calls, also, Sarda, and which he says is called by Pliny, Pelamydes. It will be seen, then, that these names, which are retained by modern naturalists, were used by the earliest writers to designate species very closely allied. Storer says: "This species, known along our coast as Horse Mackerel and Albicore, comes on to Massachusetts Bay about the middle of June, and remains until October. It is frequently taken for its oil, which is removed from the head and belly by boiling. A single specimen has furnished some twenty gallons of oil. They are harpooned like a Whale, and I have learned from fishermen of veracity, that instances have occurred in which food has been taken by them from the hand when held to them from a boat. They feed upon menhaden and other small fishes, which they frequently drive ashore." DeKay says it is met with in New York market every season. Its length is nearly ten feet, and, in

some instances, its weight is over a thousand pounds. Its beautiful form, resembling the Mackerel, renders it an object of wonder when exposed on the beach, as we have seen it at Nahant, where the fishermen often harpoon it while seining for Menhaden.

THE LITTLE TUNNY (*Orcynus alliteratus* (*Raf.*), *Gill*).—Called, also, ALBICORE, and, in Naples, ALLETERATO; in Bermuda, MACKEREL. It is an ocean Fish, occasional on our coast. In 1871 it was seen in large numbers at Wood's Hole. We have seen them in large schools around Nahant.

SPANISH MACKEREL (*Cymbium maculatum* (*Mitch.*), *Cuv.*)—Called, also, SPOTTED MACKEREL and BAY MACKEREL. This is rare in Massachusetts Bay, though common in the waters off New York. It is sold as a luxury in New York market.

RING-FISH (*Cymbium regale* (*Bloch*), *Cuv.*)—Called, also, CERO and BLACK-SPOTTED SPANISH MACKEREL. This is regarded as good eating, and is much prized by the people on the Southern coast. Ranges from Cape Cod to Florida.

FAMILY—CARANGIDÆ.

HORSE-FISH (*Vomer setipinnis* (*Mitch.*), *Ayres*).—This is called JOROBADO in Cuba, and has a range from Maine to Florida. It is described by Mitchill as Zeus setapinnis (THE BRISTLY DORY), and by DeKay as V. browni (THE BLUNT-NOSED SHINER). It is a singular-shaped Fish; is esteemed as food, and reaches the length of one foot. It is found on our coast from Maine to Florida.

SILVER MOON-FISH (*Selene argentia, Lac.*)—This is also called JOROBADO in Cuba. Its range is from Cape Cod to Florida. Another species, called by the same trivial name in Cuba, is the Argyriosus vomer, Lac., with a range from Cape Cod to Florida. This is the Zeus vomer of Linnæus, Rostrated Dory of Mitchill, and Rostrated Argyreiosus of DeKay.

HAIR-FINNED ARGYREIOSE (*Argyriosus capillaris* (*Mitch.*), *DeKay*).—This is figured and described by Mitchill and DeKay. Its range is from Cape Cod to Florida.

ROUND ROBIN (*Decapterus punctatus* (*Mitch.*), *Gill*).—This species is called DOTTED SCAD. Its range is from Cape Cod to Florida. The MACKEREL SCAD (D. macerellus, Cuv. and Val., Gill,) has the same range.

BIG-EYED SCAD (*Trachurops crumenopthalmus* (*Bloch*), *Gill*).—Called CHICARRO in Cuba, and GOGGLER or GOGGLE-EYED JACK in Bermuda. Its range is from Cape Cod to Florida.

JACK; YELLOW CREVALLÉ (*Paratractus pisquetos* (*Cuv. and Val*), *Gill*).—Called in Bermuda BUFFALO JACK, and in Cuba COJINUA. Range from Cape Cod to Florida.

HORSE CREVALLÉ (*Carangus hippos* (*Linn.*), *Gill*).—Called JIGUAGUA in Cuba. Ranges from Cape Cod southward.

YELLOW MACKEREL (*Carangus chrysos* (*Mitch.*), *Gill*).—DeKay records and figures this as Caranx punctatus (SPOTTED CARANX). Mitchill calls it the HIPPOS MACKEREL. Its range is from Cape Cod to Florida. Copallax (Cuv. and Val., Girard), called Jurel in Cuba, is found in waters about South Carolina. Another genus, nearly allied, is Carangops falcatus (Holb.), Gill, which is also found on the South Carolina coast.

THREAD-FISH (*Blepharichthys crinitus* (*Akerly*), *Gill*).—Ranges from Cape Cod to Florida.

CASABE (*Chloroscombrus chrysurus* (*Linn.*), *Gill*).—This is a Cuban named Fish, found as far north as Cape Cod.

SHORT POMPANO (*Trachynotus ovatus* (*Linn.*), *Gunth.*)—Called in Cuba PALORRIETA. Ranges from Cuba to Cape Cod.

GLAUCOUS POMPANO (*T. glaucus, Cuv. and Val.*)—Habitat, South Carolina to Florida.

POMPANO (*T. carolinus* (*Linn.*), *Raf.*)—This is a common and much-prized Fish in the Southern States. It is called CAVALLÉ or CREVALLÉ in South Carolina, and POMPYNOSE in New Orleans, derived, no doubt, from the peculiar profile presented by this Fish. As an edible it is regarded as one of the best, though the number caught is quite limited to the requirements of the South. It is not often seen in the markets of the Northern States, excepting as a salted Fish, and in this form it is a choice delicacy. It ranges from Cape Cod to Florida.

PILOT-FISH (*Naucrates ductor* (*Linn.*), *Raf.*)—Called in Cuba PILOT and ROMERO. This is an ocean Fish, occasionally seen on the coast. Mitchill describes it as Scomber ductor. The ancients asserted that it joined the tempest-tossed bark, and indicated to the master the nearest land, leaving him as soon as he had arrived in sight of the desired haven. Hence the name, Pilot.

FAMILY—CORYPHÆNIDÆ—(*Dolphins*).

The term *Coryphenes* would be more appropriate for the head of this family, as the Dolphins of the ancients are Cetaceans, or whale-like Mammals. This family is, then, wholly different from the celebrated one of the early writers. No ancient author gives an account of the species of Coryphene that is clearly defined. The present group, then, is comparatively modern in its history, the species being the Dolphins of mariners, not those of poets. It is probable that the Coryphene originally derived its name Dolphin from the fact that the head rises abruptly in shape very closely like that of the true Dolphins. The term Coryphæna is from the Greek, referring to the top crest which thus simulates the beautiful profile of the latter. A good figure and description of a "Dolphin" is in Marcgravi's *Hist. Rerum Nat. Brasil*, 1648, which he calls GUARACAPEMA. The Coryphenes are exceedingly voracious, the Flying-fishes being their especial prey. One species, the C. hippurus, is said to be five feet in length, and preys upon the larger forms. The colors of these Fishes are beyond description. As seen from the side of a sailing vessel, while the Coryphene is playfully accompanying it, the most prominent feature is a gleam of golden light, almost like a corruscation in its intensity, meteor-like in its velocity, and yet seemingly

circumscribed, like sheet-lightning, as it darts forth and partially turns on its sides, all the while maintaining its relative position to the vessel with remarkable facility.

LESEUR'S DOLPHIN (*Coryphæna seuri, Cuv. and Val.*)—This is a pelagic species, as, indeed, others are, and only occasionally makes its appearance near shore.

THE SMALL-SPOTTED DOLPHIN (*C. punctulata* (*Cuv. and Val.*), *Gunth.*) has the same range. This species is figured by DeKay as THE SPOTTED LAMPUGUS (Lampugus punctulatus), who describes it as an exceedingly rare and beautiful Fish.

FAMILY—STROMATEIDÆ.

This family is named from the Greek—*Stromateus*—parti-colored Fish. These forms were at one time included with the *Scombridæ*, but they are now seen to differ essentially. There are not many of the family, but their distribution is very extended. Besides the three here recorded, one species inhabits the California waters. About fifteen species are known.

BLACK RUDDER FISH (*Palinurichthys perciformis* (*Mitch.*), *Gill*).—Ranges from Maine to Cape Hatteras. This species is described by Mitchill as PERCH CORYPHENE, and Storer, as THE BLACK PILOT (Palinurus perciformis). The latter remarks that "It follows vessels, or keeps near old casks or planks that are floating, and sometimes is found near the wharf-logs in the harbor of Holmes' Hole." In 1815 several dozens of these followed a ship into the harbor of New York, and one of them was taken by the hook at the wharf in the month of August. Mitchill figured this latter specimen. * * * It is now regarded as common enough to have received a popular name. Among the fishermen it is called SNIP-NOSED MULLET.

HARVEST-FISH (*Poronotus triacanthus* (*Peck*), *Gill*).—So named in New Jersey; BUTTER-FISH in Massachusetts, and DOLLAR-FISH in Maine. Peck named it Stromateus triacanthus; Mitchill as CRYPTOUS BROAD SHINER (S. cryptosus); Storer as SKIP-JACK or THREE-SPINED PEPRILUS (P. triacanthus); DeKay as SHORT-FINNED HARVEST-FISH (Rhombus triacanthus). The last writer says it is equally notable for the splendor of its coloring and its excellence as an article of food. "This species was first described by Peck in 1794, who obtained his specimens from the coast of New Hampshire. At Cape Cod it is named SHEEP'S-HEAD, and is taken along the Massachusetts shore in considerable numbers in nets, with Bass and Mackerel. I have known a specimen taken from one of the wharves of Boston. A peculiarly unpleasant odor is emitted from this Fish when opened, resembling somewhat that of sulphuretted hydrogen, which sometimes produces faintness, accompanied with headache. It is used as a bait for Striped Bass. By some it is considered an excellent pan-fish. Being very oily it is used as manure upon several portions of Cape Cod."—*Storer.* Peprilus gardeni (Bloch, Schneider), Gill, is another genus, with a range from New York to Florida. DeKay figures and describes a LONG-FINNED HARVEST-FISH (Rhombus longipennis), and Mitchill the same as Stromateus. Peprilus alepidotus of Cuvier is synonymous.

FAMILY—BRAMIDÆ.

Pteraclis carolinus is alone in this family as a member of the American group. DeKay includes it in his family *Scombridæ*, as an extra-limital species. It is found on the coast of South Carolina.

FAMILY—LAMPRIDIDÆ.

This family is characterized by absence of teeth in the adult, very compressed body, small deciduous scales, small mouth, long, undivided dorsals, and a large air-bladder which has two parts posteriorly; other features are also seen in the gill-rays, fins, etc. A single genus is known, and one species is supposed to be the limit.

OPAH (*Lampris guttata, Retz*).—Seen occasionally off Greenland. This Fish remained until recently unknown to students of nature, notwithstanding its remarkable colors and beautiful shape. It is named Zeus luna by Linnæus; Chrysoste lune by Lacepede, and L. guttata and L. luna by others. In Norway it bears the name LAXETOYE, or the LARGE SALMON. Couch, in *History of British Fishes*, says the latter name was applied by Peter Claussen in 1632, his specimen weighing one hundred and forty pounds. A Scandinavian name is GLANSFISK. The term Opah is thought to have been adopted from an African designation; a native prince of the latter country having seen a resemblance to one of the Fishes of his region. The term King-fish is applied to it, as it is said, because from its beautiful colors it looks like one of Neptune's lords dressed for a court-day. Couch describes this as an English species, and says: "Nilsson informs us that it has been taken on the coast of Norway time out of mind." Its flesh is regarded as good as that of Salmon, which it resembles much in flavor and color. It is rare in English waters. This author records several examples, with this remark: "We think it material to the history of a Fish, the habits of which are so little known, to preserve those dates as a contribution towards an explanation of the causes which may entice or drive it from its native depths." This and the Bergylt or Sebastes, are cited as examples of the existence of some of the more brilliantly colored fishes living not only in the coldest regions, but in the deepest waters. Specimens of this Fish have been taken measuring five feet in length. Its color is a bright green above, with reflections of purple and gold. The fins and eyes are scarlet, and numerous round golden spots are on the sides. Sibbald first noticed and figured this Fish, in *Scotia Illustrata*, from a specimen taken in the Firth of Forth. The Icelanders, according to Faber, esteem the Fish as food, and it is said to be "not uncommon among the Shetland Islands." Reinhardt records several specimens as having been taken on the coast of Denmark; M. Risso notices it

in the Mediterranean; Cuvier was of the opinion that "there is no trace of its existence on the coast of America;" but we have the authority of Gill that it is occasional off the coast of Newfoundland.

FAMILY—MULLIDÆ.

This family derives its designation from *Mullus*, the ancient Latin name of the Red or Sur-mullet, the typical genus, a Fish familiar to the ancients in song and story. Belon figures several that are evidently of this group. Aristotle records an account of the Mullet fishing in the Mediterranean Sea and near the coast of Greece. Oppian commemorates in verse his knowledge of the Fish and its peculiar habits. When opposed by the seines it is said that the leaders of a shoal leap the barrier, when all follow, like so many sheep. Oppian has it:

> "The Mullet, when encircling seines enclose,
> The fatal threads and treacherous bosom knows,
> Instant he rallies all his vigorous powers,
> And faithful aid of every name implores;
> O'er battlement of cork up-darting flies,
> And finds from air the escape which sea denies."

There are three species in England, but in our waters only one, and that as an occasional straggler from the West Indian waters. This family, though having a similar name, is not to be confounded with *Mugilidæ*, which is noticed further on.

FAMILY—BERYCIDÆ.

SQUIRREL-FISH (*Holocentrum sogho, Bloch*).—This is an accidental straggler on our coast, but common in Bermuda and the West Indies, where it is called Matagæla. It is a beautiful species, the large eye and uniform red color reminding one of the Norway Haddock, and the extreme slenderness of the body behind the dorsal fin is quite unique. It has been very successfully kept at the New York Aquarium.

FAMILY—SCIÆNIDÆ.

The family name is derived from Sciæna, a large Mediterranean species. The characters are seen on the more or less elongated and depressed body, ctenoid scales, which are distributed in oblique rows, double nostrils, mouth with a lateral cleft, acute teeth, situated in bands on the jaw, and an unarmed palate. The family is represented by about one hundred and forty species, distributed in various regions of the world. Belon gives an illustration of a species which he names *Maigre*, or *Sciæna*, and *Umbra*, and is a very good figure of the Drum-fish, which is related to this group. The Sciæna of the ancients was a celebrated Fish, now known as S. aquila; its weight often reached sixty pounds. It was much esteemed by the Romans. The head was highly-prized, and a custom prevailed to present this part to the principal city functionaries as a sort of tribute. The ear-bones, ossicles or otoliths, are large, and in ancient times they were prized as "colic stones," being encased in gold, and worn around the neck as a preventive of the colic. The Maigre is reputed to emit sounds like those of the Drum-fish, which are heard at great depths. Cuvier regards this sound as proceeding from some function of the air-bladder. The term *Umber*, or *Umbrina*, which is applied by the ancients to one species, is from the habit noticed of quickly swimming out of sight, like a shadow. Columella states that it was one of the Fishes kept in salt-water ponds. The Maigre (S. aquila) is occasionally seen in British waters. Dr. Neill observed one in Shetland that was trying to escape the clutches of a Seal. It measured five feet four inches in length, and when raised into the boat uttered its usual purring noise.

SALMON TROUT (*Cynoscion carolinensis* (*Cuv. and Val.*), *Gill*).—SPOTTED SEA-TROUT is the designation on the Southern coast. It also bears the name of SPOTTED SILVER-SIDES. Its range is from Cape Hatteras to Florida.

SQUETEAGUE, OR SQUIT (*Cynoscion regalis* (*Bloch*), *Gill*).—This familiar species is called by the Mohegan Indians, SHECUTTS. In Connecticut it is named CHICKWICK; in New York, WEAK-FISH; at Beesley's Point it is BLUE-FISH. On the Southern coast it bears the several designations: TROUT, SALT-WATER TROUT, GRAY TROUT. Its range is from Cape Cod to Florida. Mitchill recorded this Fish as Roccus comes, because it was so much the companion of the Bass. He has since named it Labrus squeteague. Schneider records it SCUTEEG and SCUPPAUG (Johnius regalis); Cuvier as Otolithus regalis. DeKay and Storer follow the latter nomenclature. The term Weak-fish is derived from its feeble resistance on the hook, and the facility with which it breaks away from it. DeKay remarks: "Although this Fish is extensively eaten, it may be ranked among those of a secondary quality." In New Orleans it is not uncommon, where it is named Trout. According to Storer, many years since the Weak-fish was abundant in the vicinity of Nantucket, but since 1867 it has disappeared. Dr. Yale writes to Dr. Storer: "The Squeteague has deserted these waters; there has not been one taken for three or four years about here; they left about the time the Blue-fish came. The Blue-fish is regarded as its avowed enemy." C. thallassinus (Holb.), Gill, and C. nothus (Holb.), Gill, are known to the same waters.

THE BIG DRUM (*Pogonius chromis, Lacep.*)—Inhabits from Cape Cod to Florida. This is Labrus of Linnæus, and Mugil gigas of Mitchill. It is also called BLACK DRUM (Sciæna fusca), and RED DRUM (Sciæna gigas), of the same. This results from these being two strongly-marked varieties, which have since been found to be one species. DeKay says: "This is a large and deep Fish, its length being usually about three feet, with a depth of about fifteen to eighteen inches. One of this size weighs about twenty-five pounds. I have heard of their weighing more than eighty pounds." They are not esteemed as food, though the young are eaten and thought to be delicate. This Fish has proven to be one of the most hardy as an aquarium specimen.

YELLOW-TAIL (*Liostomus xanthurus, Lacep.*).—Ranges from Cape Cod to Florida.

LAFAYETTE FISH (*L. obliquus* (*Mitch.*), *DeKay*).—This is usually simply called THE LAFAYETTE, and derived this name from its having appeared in great numbers in 1824, when Lafayette re-visited this country. Its habit is to appear in large shoals at long periods, and, though known to science, it was then new to the public. It is called GOODY at Cape May; CHUB and ROACH in Virginia.

SILVER PERCH (*Bairdiella punctata* (*Linn.*), *Gill*).—This is so named, trivially, in New Jersey. Its range is from Cape Cod to Hatteras.

BASS; RED BASS; SEA BASS (*Sciænops ocellatus* (*Linn.*), *Gill*).—Called, also, SPOTTED BASS in Carolinas, and RED-FISH in the Gulf of Mexico. Ranges from Cape Cod southward. It is Perca ocellata of Linn.; Centropome œillet and Lutjanus triangulum of Lacep., and BEARDLESS DRUM (Sciæna imbebis), of Mitch. Lesenr states that this Fish is common at New Orleans, and is said to measure from eight inches to three feet in length. It is highly esteemed as food. DeKay records it as BRANDED CORVINA (C. ocellata). On each side of the caudal fin is a blackish-brown mark, bordered with white, which Mitchill states resembles a branded spot; hence the name.

KING-FISH (*Menticirrus nebulosus* (*Mitch.*), *Gill*).—Called in New Jersey, WHITING, HAKE and BARB. It is the BERMUDA WHITING of Garden; Perca alburnus, Linn.; Alburnus americanus, Catesby; WHITING of Schœpff; Johnius regalis, Schneider; Centroponus alburnus, Lacepede; Sciæna nebulosa (KING-FISH), Mitchill; L'OMBRINE DES ETAS UNIS, Cuvier and Val.; Umbrina nebulosa of Storer. DeKay says it is not very abundant, appearing in our waters in July and August. On account of its excellence the early settlers named it King-fish. It is exceedingly abundant on the coast of Florida and Carolina, where it is known as Whiting. A few wander as far north as Cape Cod and Boston Bay. Two other species are known: M. littoralis (Holb.), Gill, called SHORE WHITING, with a range from Cape Hatteras to Florida, and M. undulatus (Linn.), Cuv. and Val., called THE CROAKER, and in Cuba, VERRUGATO. The latter ranges from Cape Cod southward.

BANDED DRUM (*Larimus fasciatus. Holbrook*).—This Fish is also called GRUNTER, YOUNG DRUM, GRUNTS, and YOUNG SHEEP'S-HEAD. It is recorded by DeKay as Pogonias fasciatus. Mitchill named it Mugil grunniens and, later, Labrus grunniens. DeKay says it appears in our waters from the south in October and November, and sometimes as early as September.

FAMILY—GERRIDÆ.

One American species only, indicated as doubtful as to genus and species, is recorded as belonging to this family—Eucinostomus argenteus, Baird and Girard. Habitat, from New Jersey southwards.

FAMILY—PIMELEPTERIDÆ.

BREAM (*Pimelepterus bosci, Lac.*) — Named CHOPA-BANCA in Cuba. Habitat, from Cape Cod to Cuba.

FAMILY—SPARIDÆ.

This family derives its name from the typical genus Sparus. The Porgee and Sheep's-head are notable forms. The scales are obsoletely pectinated, striæ crossing the surface diagonally, and meeting the sides at acute angles. The lateral line is continuous to the caudal fin. There are numerous species, well represented in the warmer countries, as well as in temperate regions.

SARGO (*Lagodon rhomboides* (*Linn.*), *Holb.*)—This is so called in Cuba. Its range is from Cape Cod to Florida. It is the Sparus rhomboides of Linnæus; SALT-WATER BREAM of Schœpff. DeKay describes it as the RHOMBOIDAL PORGEE.

SHEEP'S-HEAD (*Archosargus probatocephalus* (*Walb.*), *Gill*).—Ranges from Cape Cod to Florida. This is the choicest Fish, probably, known to our coast; its flesh being compared to the English Turbot. Cuvier names it LE SARGUE, TETE DU MOUTON. Mitchill records it as Sparus ovis. The Sheep's-head, so called from the appearance of its mouth and teeth, breeds along the coast, entering the shallow bays on Long Island in June, where they are caught in great numbers in seines. It is a wary, timid Fish, occasionally weighing from twelve to sixteen pounds, and to take it by the hook requires much dexterity.

SCUP (*Stenotomas argyrops* (*Linn.*), *Gill*).—So called in Massachusetts at Vineyard Sound, and SCUPPAUG and PORGEE at New York. It is known in Rhode Island as BREAM, and on the eastern shore of Virginia as THE FAIR-MAID. DeKay names it BIG PORGEE (Pagrus). It is Sparus of Linnæus; Spare zanture of Lacepede; BIG PORGEE OF NEW YORK (Labrus versicolor), Mitchill. This is a well known and beautiful Fish, and occurs in our waters in great abundance in the summer season. It is an excellent edible, and would be prized were it not so plentiful. The term *Porgee* is supposed to be of Indian origin.

GILT-HEAD (*Sparus aculeatus* (*Cuv. and Val.*), *Gill*).—This species is stated to be doubtful as to both genera and species, and its habitat from Cape Cod to Hatteras. DeKay records it as Chrysophris aculeata.

GRUNTS (*Hæmulon arcuatum, Cuv. and Val.*)—This is a Southern species. The following are also from the same localities, along the South Atlantic coast: H. chrysopteron (Linn.), Cuv.; H. quadrilineatum, Cuv. and Val. (called STRIPED GRUNTS); Orthopristis fulvomaculatus (Mitch.), Gill. This latter is found in New York Harbor at times in considerable numbers. DeKay calls it SPECKLED RED-MOUTH, and Mitchill SPECKLED GRUNTS.

GLASS-EYED SNAPPER (*Lutjanas caxis* (*Bloch, Schn.*), *Gill*).—This is also called YELTING in Bermuda. Its range is along the Southern coast.

FAMILY—SERRANIDÆ—*Gill.*

This family derives its name from the term *Serranus*, the type species; the serrated operculum giving rise to the designation. "The single elongated dorsal fin," says Yarrell, "distinguish these forms from

Perca and Labrax." The Smooth Serranus, according to Carolini and Cuvier, as well as some others of this group, are true hermaphrodites; one portion of each lobe of roe consisting of true ova, the other having all the appearance of a perfect milt, and both advancing to maturity simultaneously. It is not conclusive that such Fishes have the power of impregnating their own ova.

SOAP-FISH (*Promicropterus maculatus* (*Holb.*), *Gill*).—This is an unfamiliar Fish, ranging from Cape Hatteras to Florida. P. decoratus, Gill, recorded as doubtful as to species, is accidental on our coast; once found at Newport, R. I. Hyporthodus flavicauda, Gill, is recorded as the same.

RED GROUPER (*Epinephelus morio* (*Cuv.*), *Gill*).—The range of this Fish is from Cape Cod to Florida. DeKay records a Serranus erythrogaster, with the trivial name THE GROUPER, which he says is "called by the fishermen RED GROUPER. It is a Southern species, brought hither from the reefs of Florida. I have been assured by intelligent fishermen that it has been occasionally but rarely taken off our coast." This is probably the Fish which forms the staple article of the Connecticut fishermen who visit the Florida reefs in the cold season to fish for the Havana market. The Grouper is there regarded as a good Fish, though its flesh is tough and dry. E. nigritus (Holb.), Gill, doubtful as to genus, and E. oxypterus (DeKay), Gill, doubtful as to genus and species, are enumerated as accidental visitors; Trisotropis acutirostris (Cuv. and Val.), Gill, ranges from Cape Hatteras to Florida; Pomicrops guasa (Poey), Gill, called in Cuba, GUASA, is known in the Florida waters.

BLACK SEA-BASS (*Centropristis atrarius*, (*Linn.*)—This Fish ranges from Cape Cod to Florida. It is named SEA-BASS in New York; BLACK-PERCH in Massachusetts; BLACK-BASS and BLACK-FISH in New Jersey; BLUE-FISH in Newport, and BLACK-WILL in Virginia. DeKay says it is one of the most savory and delicate Fishes that is found in our market from May to June. Mitchill described it as Perca varia. Storer says they are taken to Boston from New Bedford, but they seldom wander into Massachusetts Bay. Triloburus trifurcus (Linn.), Gill, ranges from Cape Hatteras to Florida.

SERRANO (*Diplectrum fasciculare* (*Cuv. and Val.*), *Holb.*)—This is known to range from Cape Hatteras to Florida. The trivial name is common in Cuba.

COACHMAN (*Dules auriga, Cuv. and Val.*)—Called, also, CHARIOTEER. Ranges from Cape Cod to Florida. DeKay remarks: "This species can only be regarded in the light of an accidental visitor. It is a tropical species."

FAMILY—LABRACIDÆ.

Pliny says: "*Labrus*, a kind of ravenous Fish." This name has been perpetuated in the genus Labrax, or Labeo. This family has the general characters of the *Percidæ*, but has three anal spines, and the spines of the dorsal reduced in number, generally nine or ten. Teeth are situated on the tongue in our native species. There are fifteen genera and about thirty-five species, mostly found in Northern waters. The larger number are marine, though their habit is to enter the fresh-water streams.

STRIPED BASS (*Roccus lineatus* (*Bloch, Schn.*), *Gill*).—Called ROCK-FISH in Pennsylvania; MISSUCKEKEKEQUOCK by the Narraganset Indians. Its range is from Nova Scotia to Florida. This is a highly-prized Fish for angling. Our markets are stored with them, says Dr. DeKay, throughout the year. They ascend high up the Hudson River, and have been taken under the Cohoes Falls on the Mohawk. The larger ones, called Greenheads, are never seen so far away from salt-water. This Bass is caught in Massachusetts Bay, and is not unfrequently taken by the hook from the rocks. We have taken them at Nahant, while angling for Tautog. Small ones are seined in considerable numbers near Chelsea and Nantucket. The Squid (Loligo) is used as a bait, and the Bass is said to feed upon them, giving rise to the trivial name of the Fish in Massachusetts Bay, SQUID HOUND. Dr. Storer saw one which weighed thirty-six pounds, which was taken from one of the city bridges. The largest individual he had seen weighed eighty-four pounds.

WHITE PERCH (*Morone americana* (*Gmelin*), *Gill*).—Inhabits along the coast from Nova Scotia to Florida. DeKay figures and describes the LITTLE WHITE BASS (Labrax pallidus), which we take to be this Fish. He says: "It is commonly known with us as White Perch." Mitchill records it as Moroue pallida, and later as Bodianus. "Being a diminutive Fish it is seldom brought to market." Dr. Storer records under the head "WHITE PERCH" (Labrax rufus, DeKay), what Mitchill described as RED PERCH (Bodianus rufus), and the same as DeKay gives as a second species, which he names RUDDY BASS (L. rufus). Dr. Storer says of the latter: "By the fishermen it is known as WHITE PERCH. Its usual weight is about a pound." Dr. Storer regarded these as probably the same, and as Dr. Gill does not introduce two, it is reasonable to regard them as identical.

FAMILY—EPHIPPIIDÆ.

This group has been included with the *Chetodons*, but now forms a separate family. The genus Ephippus, the typical one, has the dorsal fin deeply emarginate between the spinous and soft rays; the spinous portion, which is scaleless, is fitted to fold into a groove formed by the scales of the back.

MOON-FISH (*Parephippus quadratus* (*Gunth.*), *Gill*).—Ranges from Cape Cod to Florida. DeKay records a species as "MOON-FISH" (Ephippus gigas, Cuv.), which is presumed to be this Fish. He says it is rare on our coast, but ranges to Rio Janeiro, and probably still further south.

THREE-TAILED PORGEE (*P. faber* (*Cuv.*), *Gill*).—This is figured and described by DeKay as Ephippus faber. Mitchill described it as CLOUDY CHETODON (Chetodon oviformis). Sloan, in *History of Jamaica*, names it Faber marinus. In South Carolina it is called ANGEL-FISH, and THREE-TAILED SHEEP'S-HEAD

is another trivial designation. It is periodical in its appearance here. Dr. DeKay says: "About twenty years since they were caught in great numbers here in seines, and exposed in our markets for sale. Some of them were eighteen inches long."

FAMILY—LOBOTIDÆ.

This group is a portion of what constituted the family *Scienidæ*, now separated and represented in our waters by only one genus.

FLASHER (*Lobotes surinamensis, Cuv.*)—Ranges from Cape Cod southward. This is called TRIPLE-TAIL and T. PERCH, from the peculiar tail-like aspect of the dorse and anal fin. Mitchill described it as the latter (Bodianus triurus). BLACK GRUNT is also a trivial name.

FAMILY—POMATOMIDÆ.

BLUE-FISH (*Pomatomus saltatrix* (*Linn.*), *Gill*).—This much esteemed Fish retains the specific name bestowed on it by Linnæus; its habit of jumping out of the water suggesting it. Mitchill described and figured it as HORSE MACKEREL (Scomber plumbeus). It is known by that trivial name at present in Newport and Beesley's Point, N. J. In Virginia it is called TAILOR, and in other places SNAP MACKEREL and WHITE-FISH. Linnæus used the term SKIP-JACK and GREEN-FISH, and the generic one Gasterosteus. Shaw records it SKIPPING STICKLEBACK; Lacepede, the POMATOME SKIP. Temnodon has been used later, by most American writers, as the generic term. The remarkable change of habitat of Fishes is exemplified in this species. Dr. Smith records (*History of Fishes of Massachusetts*, 1833)—"HORSE MACKEREL (*S. plumbeus*): On the authority of Dr. Mitchill we notice the existence of this little Fish, thirteen inches long, with a name that is associated with the idea of something large enough to swallow a horse. Not a single specimen could be procured last season in the vicinity of Boston." About 1850 single individuals were taken at Nahant and in Boston Bay, and were in great request, selling for high prices. The Fish is now quite plentiful in those waters. Storer says: "For a long series of years it disappeared from our waters, though it was once plentiful and was held in high estimation by the aborigines." The Blue-fish is regarded as one of our best for the table, but in the spring it is almost worthless from being too lean, and in autumn it is too fat. It is very destructive to the Mackerel fishery; a shoal is always the precursor of a grand scattering of the latter. The Blue-fish affords excellent sport, as it takes the hook sharply in trolling. In some portions of our coast considerable attention is paid to this sport. With a good breeze, in a boat under full sail, the lines trolling behind, one may experience a good share of the pleasures of angling. The range of this Fish is remarkable; it is seen in the Mediterranean, in the Indian Ocean and near New Holland.

FAMILY—ELACATIDÆ.

CRAB-EATER (*Elacate canadus* (*Linn.*), *Gill*).—Ranges from Cape Cod to the West Indies. Linnæus used the generic term Gasterosteus; Bloch records it as Scomber niger; Lacepede as Centronote gardenien; Mitchill as C. spinosus. DeKay figures it as the NORTHERN CRAB-EATER (E. atlantica), and remarks that his specimen "was taken in a seine in Boston Harbor, and, being put into a car with several Porgees, the latter were soon eaten by him." He says it is a rare and probably solitary Fish. Its geographical range is very great, being found on the coast of Africa, and on our coast from 42° north to Brazil. Being too rare to have received a popular name, DeKay has adopted the present one.

FAMILY—CHILODIPTERIDÆ.

This family is represented by one genus and one species, which is strictly West Indian, though occasional on our coast. It has been found on the beach at Newport, R. I. The species is Apogonichthys americanus, Castelnau.

FAMILY—PRIACANTHIDÆ.

COMMON BIG-EYE (*Priacanthus macropthalmus, Cuv.*)—This is recorded as a doubtful species, found in the West Indies and occasionally northwards.

SHORT BIG-EYE (*Pseudopriacanthus altus, Gill*).—Called, also, BLEEKER; is found from Cape Cod to Cape Hatteras.

FAMILY—AMMODYTIDÆ.

SAND-EEL (*Ammodytes americanus, DeKay*).—Called SAND LANCE in New England. Ranges from Newfoundland to Hatteras. Described by Mitchill as A. tobianus. Specimens frequently wash ashore after or during storms. It has the habit to bury itself in the sand. DeKay says it is not a rare species, but, from its insignificant size, never appears in our markets. Storer records it as SAND-EEL (A. americanus), and Ayres, A. lancea. The former author writes: "This species is found plentifully at Holmes' Hole, and is often collected at Provincetown in myriads." The shores are often lined with these Fishes, left by the tide. The water in the vicinity of Long Point, Provincetown, according to Captain Atwood, is at times literally alive with them. "They have been known to come ashore in such quantities that they covered the ground from one to two inches deep, and when the water covered the flats the whole bottom looked like an immense sheet of silver." Ammodytes dubius, Reinhardt, is another species, ranging from the Polar regions to Cape Cod.

THE BANDED SAND-LAUNCE (*Argyrotænia vittata* (*DeKay*). *Gill*).—Recorded by Gill as doubtful as to genus and species, and its habitat placed New York (?). DeKay figures and describes it as Ammodytes vittatus, but expresses great doubt about the genus.

FAMILY—ECHENEIDIDÆ.

This family embraces four genera, of which the Remora (Echeneis) is the type. Formerly the term *Cyclopteridæ* was used to include in one family a larger number of varied forms, which were provided with sucking discs.

INDIAN REMORA (*Leptecheneis naucrates* (*Linn.*), *Gill*).—This is seen on the coast generally. Mitchill described it the BIG OCEANIC SUCKER, and Richards as the SHIP-MASTER ECHENEIS. E. naucrateoides (Zuiew.), Gill, is said to inhabit the same regions as the latter. An allied form, the Rhombochirus osteochir (Cuv.), Gill, is occasionally found on our coast. Remoropsis brachyptera (Lowe), Gill, is also an accidental visitor.

COMMON REMORA (*Echeneis remora, Linn.*)—Called PEGA in Cuba. This Fish is well known in Europe, and is found on our coast, usually accompanying some species of Shark or large Fish, upon which it clings by aid of its sucking disc. The Greeks and Romans were well acquainted with it. The E. naucrates—mentioned before as Leptecheneis—was equally known, and was the subject of song and story, as well as the present. Ælian writes of both. Oppian commemorates in verse its supposed great powers:

> "The Sucking-fish beneath, with secret chains,
> Clung to the keel, the swiftest ship detains."

Pliny repeats the same wondrous story. Antony's ship, at the battle of Actium, was said to be detained by the action of a Remora which clung to the bottom. Pennant records this species as inhabiting the ocean quite to North America, and being often found adhering to the sides of Sharks, by means of the structure of its head, as to be got off with difficulty. Smith gives an account of the use formerly made by the natives of Cuba with the Remora, by attaching a strong twine round its tail, and then throwing it overboard. The Remora naturally made for the first Fish which the length of line permitted it to reach, and after fastening itself firmly to its prey by the sucking disc, Remora and his prey were hauled in. A specimen of the WHITE-TAILED REMORA, described by DeKay as E. albicauda, was kept alive a short time in the New York Aquarium. Its habits were peculiar while confined. It was occupied much of the time in forward and backward movements; its long dorsal and anal fins worked like the screw of a propeller ship. When it did swim off it presented a remarkably graceful shape and motion. We have frequently taken this species off Sharks at Nahant Beach, and from the great Blue Shark of the Southern waters. Though great care was exercised, we could not keep it alive in captivity. Storer describes and figures a species with fourteen plates to the disc, which is much shorter than the albicauda. It is probably identical with the present, as Gill's list does not include it.

FAMILY—SPHYRÆNIDÆ.

The family name is derived from the typical genus Sphyræna, which is distinguished by its pike-like form, having two distinct dorsal and abdominal ventral fins. The scales are small and cycloid in form. The lateral line is continuous. The teeth are well developed (small and large grouped together) on the palatine bones as well as on the jaws. The two dorsal fins are situated far apart; the first with five spinous rays; the second with a spine and eight to ten articulated rays. The vertebræ are only about twenty-four in number. The air-bladder is large and bifurcate. The family is represented in tropical and sub-tropical seas in all quarters of the globe. Species wander extensively. One of the largest is the celebrated Barracuda of the Cuban waters.

NORTHERN BARRACUDA (*Sphyræna borealis, DeKay*).—This is a small, insignificant Fish, compared with the great Barracuda of the Gulf of Mexico, being only about eight inches in length. DeKay says it is a very active and voracious little Fish, appearing in August and September. The West Indian species grows to the length of four feet, and is much prized as a savory edible in Havana and in Key West. It is taken by spearing. The fishermen scull the boat gently from the direction of the sun, the habit of the Fish being to satisfy its curiosity by following any object, which, in this case, is the blade of the oar. The fisherman has the advantage, being with his back to the sun, the Fish consequently has it in his eyes; this is a favorable situation for striking with the "grains" or spear. The larger Barracudas are taken in this manner. Gill says it is much feared on account of its savage disposition and formidable teeth. Its flesh is often poisonous, though at other times quite savory. This quality depends on a peculiar condition, and is said to be co-ordinated with a milky *sanies* which follows the knife on the Fish being cut.

FAMILY—MUGILIDÆ.

This family is named from its typical form, the Mugil, or Mullet. It has cycloid scales, moderate in size. The lateral line is absent. The teeth are very small or entirely absent. There are two dorsal fins: the first having always four stout, rigid, diverging spines; the second with nine rays (rarely eight or ten), and far behind. The anal is opposite and resembles the dorsal. The vertebræ are twenty-four. This family embraces rather over a hundred species; having a strong family likeness, and agreeing, also, closely in their characters. They are mostly in the warmer waters, though a few reach the temperate regions. Though strictly belonging to the salt-water they more or less seek, at stated seasons, the fresh rivers. They are usually in large schools.

MULLET (*Mugil albula, Linn.*)—Ranges from Cape Cod to Florida. Rondelet figures several of this group; one is *Muge*.

STRIPED MULLET (*Mugil lineatus, Mitch.*)—Ranges from Cape Cod to Florida. DeKay figures this, and remarks that Dr. Mitchill first discovered the species on our coast, and named it. It appears in our markets about the first of September, and is highly prized.

ROCK MULLET (*M. petrosus, Val.*)—Ranges from Hatteras to Florida, or, as DeKay says, from Brazil to New York. PLUMIER'S MULLET (M. plumieri), called SPOTTED MULLET by DeKay, has the same range. It is regarded as unfit for food.

FAMILY—ATHERINIDÆ.

This family is one founded by Cuvier on the genus Atherina of Linnæus. The group is closely related

to the Mullets. They have two dorsals, though they are not always distinct. There are six branchial rays. Five genera are known, and about forty-five species. They are small, carnivorous Fishes, usually swimming in shoals near the shore. The North American species are all small.

SILVERSIDES (*Chirostoma notata* (*Mitch.*), *Gill*).—Ranges from Maine to Florida. It is called FRIAR in New England. DeKay records it as Atherina notata. Storer says it accompanies the Smelt into the Charles River, at Boston, in large numbers, in the spring and autumn. THE SLENDER SILVERSIDES (C. menidia (Linn.), Gill) is found from Cape Hatteras to Florida. Mitchill records it as GREEN STRIPED SILVERSIDES (A. virescens). Atherina carolina, Val., has the same range.

FAMILY—BELONIDÆ.

This family is represented here by only one species, which was formerly embraced in the *Esocidæ*.

SILVER GAR (*Belone longirostris* (*Mitch.*), *Gill*).—Ranges from Cape Cod to Florida. According to DeKay it is prized by epicures. He records it as BANDED GAR-FISH, and Schœpff as SEA-SNIPE. It is commonly known as BILL-FISH. Storer calls it GAR-FISH (B. truncata), from a specimen obtained at Holmes' Hole.

FAMILY—SCOMBERESOCIDÆ.

From *Scomber*, a Mackerel, and *Esox*, a Pike. The scales in this family are cycloid in shape. A lateral line is developed along each side of the belly. The dorsal fin is single, and far back; the anal fin is opposite the latter; the lower lobe of the caudal is the longest; the pectorals have branched rays; the ventrals are abdominal The air-bladder is generally present, but has no communication with the intestinal canal.

FLYING-FISH (*Exocœtus exiliens, Gmel.*)—Ranges from Cape Cod to Florida. THE NEW YORK FLYING-FISH (E. noveboracensis, Mitch.), has a similar range. THE SINGLE-BEARDED FLYING-FISH (Cypselurus comatus (Mitch.), Weinland) and THE DOUBLE-BEARDED FLYING-FISH (C. furcatus (Mitch.), Weinland) are recorded as doubtful both as to genus and species. They are also found from Cape Cod to Florida. Other species of this family are: Exocœtus melanurus, Val.; Halocypselus evolans (Linn.), Gill; Euleptorhamphus longirostris (Cuv. and Val.), Gill; Hemirhamphus unifasciatus, Ranzani; with the same range of habitat.

SKIPPER BILL-FISH (*Scomberesox scutellatus, Leseur*).—Ranges from Nova Scotia to Florida. Large quantities of this Fish are thrown ashore at Provincetown, Mass. By some it is regarded as good eating. Rondelet figures a form which he names *Belone*, or *Raphis;* in Latin, *Acus*. Another resembling the latter he names *Sauros*, and *Equille*. The Greek name is yet used in the form *Saury*.

FAMILY—CYPRINODONTIDÆ.

The *Cyprinodonts* have as family characters, head and body scaly; teeth well developed on the jaws and on the pharyngeals; the dorsal fin far back; the caudal fin generally rounded; there is no adipose fin; the anal fin of the male is often modified into an intromittent organ. The species are mostly viviparous. They are small, inhabiting brackish or fresh-waters in both continents, and most abundant in warm regions. There are twenty-five genera and about one hundred and twenty species. Though we have numerous species they are not well known. The species Girardus formosus is the smallest known vertebrate.

KILLI-FISH (*Fundulus pisculentus* (*Mitch.*), *Val.*) Called, also, MUMMICHOG. Ranges from Maine to Florida. It is named the ORNAMENTED MINNOW, and figured by Storer; and WHITE-BELLIED KILLI-FISH by Mitchill. DeKay calls it BANDED KILLI-FISH. It is the most common Minnow around Boston, where it is known as COBLER, and is used largely for bait.

THE BANDED MINNOW (*F. nigrofasciatus* (*Leseur*), *Val.*)—Is figured by Storer. It is found in Fresh Pond, Cambridge, Mass. Its range is from Cape Cod to Florida.

THE BARRED MINNOW (*F. multifasciatus* (*Leseur*), *Val.*)—Ranges from Cape Cod to Florida. Storer figures this Fish, and states that it is found in Concord and in Lowell, Mass., probably in the rivers communicating with the sea. The Hydrargyra is represented by two species, found from Cape Cod to Hatteras. Storer records and figures the BASSE-FRY (H. flavula). Mitchill described the same as NEW YORK GUDGEON (Esox flavulus). It is called by the boys YELLOW-TAIL, and is common around Boston in brackish water. Cyprinodon has two species, recorded as C. variegatus and C. parvus; and Micristius is represented by three species.

FAMILY—STOMIATIDÆ.

Two genera, with one species each, are embraced in this family. Malacostens niger, Ayres, is a pelagic form; Stomias ferox, Reinhardt, is known in Greenland waters.

FAMILY—SCOPELIDÆ.

Scopelus is the typical genus of this family. The members are related to the *Salmonidæ*. Some forms have scales, which are cycloid; others have none. The lateral line runs nearly parallel with the back. Teeth are on both jaws and palate. The branchial apertures are very wide. The dorsal fin is short, or of moderate length, and in the middle of the length of the body, or nearly so; the adipose fin is developed; the anal is short and posterior; the caudal is large and distinct; the pectorals have branched rays; the ventral fins are abdominal, but rather far forward as such. The intestinal canal is very short, and the air-bladder is absent. The eggs are contained in sacs of the ovarium, and are excluded by oviducts.

Scopelus glacialis. Reinhardt.—Habitat. Greenland. Is recorded by Gill as one of the Fishes of the East Coast of North America. Storer figures and describes the ARGENTINE (Scopelus humboldti (?)), which he regards as synonymous with Argentina sphyrena of Pennant. He says that only one living specimen had then been found in the waters of Mas-

sachusetts, although others were frequently found in the stomachs of Fishes. DeKay had not met with it. In this genus the mouth and gills are excessively cleft, and the tongue and palate are smooth; small teeth are in both jaws. Maurolicus borealis (Nilsson), Gunth., is recorded as doubtful as to species. Its habitat is noted as Massachusetts.

FAMILY—SYNODONTIDÆ.

Two genera of this family, each represented by only one species, are found in the waters of the East Coast of North America. Trachinocephalus myops (Bloch, Schneider), Gill, ranges from Hatteras to Florida. Synodus fœtens (Linn.), Gill, ranges from Cape Cod southwards.

FAMILY—MICROSTOMIDÆ.

The Smelt is a prominent member of this family. Its generic characters are seen in an elongated body, covered with small scales; two dorsal fins, the first with rays, the second fleshy, without rays; the teeth on the jaws and tongue are very long.

THE SMELT (*Osmerus mordax* (*Mitch.*) *Gill*).—Inhabits from Nova Scotia to Cape Hatteras. Storer says: "This beautiful species is brought to Boston market in large quantities in the spring and autumn. In the spring it is taken in nets up the rivers, and in winter by hook beneath the ice. In Watertown alone about 750,000 dozen are taken annually in scoop nets, from the first of March to first of June." A favorite amusement, when the rivers and harbors are frozen, is to fish for the Smelt through the ice. Boston harbor is a singularly lively locality during such seasons. The scene is picturesque, many devices being used to obtain shelter from the cold winds. Tents, bonfires, etc., are seen in great numbers, spreading over miles in extent. Mitchill described this Fish as Salmo eperlanus. DeKay calls it AMERICAN SMELT, and says: "This beautiful and popular Fish derives its name, Smelt, from its peculiar smell, which resembles that of cucumbers. They are derived mostly from the small streams emptying into the Sound, and from Hackensack and Passaic Rivers. It appears to vary considerably from the European species." Couch says of the latter: "It has been supposed that the name of Smelt was given on account of its agreeable odor, but the true meaning is assigned by Johnson, and is the same as that used to signify the melting or smelting of metals—the appearance of transparency of the substance of the Fish, as if it had a tendency to melt away." Rondelet figures a similar form under the name *Eperlan*, which refers to its *pearly* appearance. This name is retained as a specific designation for this Fish. The Smelt is highly prized, both here and abroad. In Scotland it is called Spirling, or Sparling. Belon figures three forms under the name *Eperlan*. One he terms the *E. fluviatilis* (River Eperlan); another is named *Eperlanus*, or *Umbla*.

Mallotus villosus (*Müller*), *Cuv.*—Called CAPELIN. Is found in the colder waters of the Polar regions, and southward to Nova Scotia. Microstoma grœnlandica, Reinhardt, is native to Greenland waters.

FAMILY—SALMONIDÆ.

This is perhaps the most notable of the families of Fishes, the typical forms, Salmon, Trout, etc., being most justly celebrated as game and as savory food. The scales are cycloid in shape, and rather small. The lateral line is distinct and runs nearly parallel with the abdomen. The dorsal fin is situated about the middle of the body; a second adipose dorsal is developed far behind; the anal is smaller than the dorsal, and situated below about midway between the two dorsal fins; the ventrals are abdominal and under the dorsal. The air-bladder is large and simple, communicating with the intestinal canal. The ovaries discharge their eggs into the cavity of the abdomen, from which they are directly excluded. Sixteen genera and one hundred and sixty species of this family are enumerated.

SALMON (*Salmo salar* (*Linn.*), *Gunther*).—This royal Fish has a range of habitat from the Polar regions to Cape Cod. It is found only in the coldest waters, and is equally distributed in Europe and America. Another species is known to the Californian coast. In some of the rivers of Maine the Salmo salar is quite abundant. It is thought that this Fish was formerly, at the time of the discovery of America, common to the more southern waters. Hendrick Hudson records: "Great stores of Salmon in the river"—but it is considered certain that the Fish meant was the "Weak-fish." DeKay says: "The Salmon now seldom appears on our coast except as a straggler. It is now only seen on our northern borders, ascending the St. Lawrence from the sea, and appearing in Lake Ontario in April, and leaving it again in October or November. They were formerly abundant in the lakes, in the interior of New York, which communicate with Ontario. The artificial impediments thrown in the way have greatly tended to prevent the progress of this Salmon through these waters." Eight other species are enumerated as inhabiting the Arctic regions. Dr. Storer says this excellent Fish is almost entirely driven out from the waters of Massachusetts by the numerous dams and manufacturing establishments, preventing it from going up the rivers to deposit its spawn. About the commencement of this century it was very abundant in the Merrimack River. Our market is now supplied from the Kennebec River and from Nova Scotia.

SEA TROUT (*Salmo immaculatus, H. R. Storer*) is recorded as a doubtful species. It is found from Labrador to Nova Scotia.

FAMILY—PARALEPIDIDÆ.

The name of this remarkable family is derived from the Greek, meaning "near to" and "scale." The form is elongate and pike-like, and the body covered with deciduous scales. The lateral line is straight and the head is pointed. The branchiostegal rays are seven in number. The dorsal fin is short and far behind, and an adipose is still further back; the anal is elongated; the caudal emarginate; the

pectorals are well developed and the ventrals are small, inserted below or in front of the dorsal. The species are closely allied to the *Salmonidæ*. There are two genera only, Paralepis and Sudis; the latter exclusively Mediterranean.

Paralepis borealis, Reinhardt, is native in the Greenland Seas.

FAMILY—ALBULIDÆ.

This is represented by only one genus and one species in our waters.

LADY-FISH (*Albula conorhynchus, Bloch and Schneider*).—Ranges from Cape Cod to Florida.

FAMILY—ELOPIDÆ.

This family is allied to the *Clupeidæ*. DeKay includes the type species, Elops, in the latter, and gives as generic characters: jaws formed like those of the Herrings; body, cylindrical; gill membrane with thirty or more rays; a flat spine on the upper and under edges of the caudal fin.

BIG-EYED HERRING (*Elops saurus, Linn.*)—This Fish is known as MATAJUELO BLANCO and REAL in Cuba. Its range is from Cape Cod southwards. DeKay figures it as SAURY, from a specimen taken in New York harbor, in the autumn.

JEW-FISH (*Megalops thrissoides* (*Bloch, Schn.*), *Gunth.*)—This is called TARPUM in Bermuda. Its range is south of Cape Cod.

FAMILY—DUSSUMIERIDÆ.

This family is represented by only one genus in our waters. DeKay describes and figures a species under the name SLENDER HERRING (Alosa teres). Gill records this form as

ROUND HERRING (*Etrumeus teres* (*DeKay*), *Brevoort*).—Range from Cape Cod to Cape Hatteras.

FAMILY—CLUPEIDÆ—(*Herrings, Shad, etc.*)

The typical genus, Clupea, which suggests the family designation, is from the ancient name used by Pliny and others of the time, to designate the Shad and like forms. Pliny gives the Roman name as *Lætam;* and that used in Venice as *Cheipam;* in Spain, *Sabogam,* and in France, *Alosam.* The various members of the family are so alike in their habits of migration that the circumstance attracted the attention of the ancients. The poet Oppian refers to this while describing one of the forms as *Chalkis,* or *Chalcis,* as follows:

> "Pilchards and Shads in shoals together keep,
> The numerous fry disturbs the mantling deep;
> No home they know, nor can confinement love,
> But, fond of hourly change, unsettled rove," etc.

Among the Greeks and Romans the Shad was known as *Thrissa,* a term still in use as a specific name of a member of this family. Aristotle treats of the Shad as named *Trichaios.* On referring to the original works of these authors we find the words used in different forms, and that they are from the same root—probably *thrix* or *trichos,* meaning hairy or bristle-like. *Trichaios* is recorded as "a hairy Fish, like a Herring, remarkable for its minute bones." The fact of the bones being small and bristle-like, is, no doubt, the origin of the term. The Egyptians were familiar with the Shad, as it passed periodically up the Nile from the sea. The ancients were especially impressed with the supposed susceptibility of these Fishes to sounds of a pleasing nature. Ælian and others of his time, as well as Rondelet, treat of this, and add that thunders had the effect to drive the shoals away after they had been enticed near shore in the manner described by Pliny as witnessed by Ausonius. The latter author affected to despise this "poor man's food." A free translation presents it: "Who does not know those frizzing, sputtering Fish on every poor man's grate!" Rondelet and Belon figure several forms, as the *Hareng, Thrissa, Alosa,* etc. The latter, which is the Shad, was named *Laccia* in Rome, and the term *Allis,* or *Allice,* which attaches to the English species, is a corruption through *Alachia, Hallachia,* etc. This family embraces forms much like the Salmons. The chief distinction is the absence of the adipose fin. The scales are particularly delicate in their attachment to the skin, and separate very easily; there are no spinous rays; the gill openings are very large; the teeth small and generally numerous. The air-bladder is always large. The eggs are exceedingly numerous, forming a roe of the greatest bulk. A few species ascend rivers, the rest are marine. They all are gregarious to a great extent, forming large shoals, and appearing periodically on the coast. Some species have a very wide geographical range. As at present determined and restricted, there are about twelve genera and one hundred and twenty species, many of which are valued highly as food.

MENHADEN (*Brevoortia menhaden* (*Mitchill*), *Gill*).—This is one of the most familiar and numerous species on our coast, having a range from Cape Cod to Hatteras. The Narragansets called it MUNNAWHATTEANG. On the coast of Massachusetts it is known as HARD-HEAD; in Maine and New Hampshire, POGY and POGHAGEN; in New York, MOSSBUNKER; in Connecticut and other parts of the Eastern coast it is known as BONY-FISH and WHITEFISH; In Carolina it is FAT-BACK, BUG-FISH and YELLOW-TAIL. Mitchill is the earliest writer on this subject—(*Fishes of New York,* 1814)—and he is supposed to be the author of the specific name Menhaden. Dr. Smith, of Boston, who wrote in 1833, claims that the word is derived from the Indian, *paar-haug,* by which the aborigines knew this Fish; hence *Pauhagen, Menhagen* and *Menhaden.* The term *Mossbonker* is used by DeKay, who says the Dutch settlers called it *Morsebonker,* and adds, also, "Panhagen and Menhaden; the latter being the name given by the Manhattans, and the former, pronounced *Pauhaugen,* the Narragansett epithet. At the east end of the island they are called *Skippaugs,* or *Bunkers.*" Storer remarks: "This valuable Fish comes into Massachusetts Bay about the middle of May, and leaves in November. It is taken in im-

mense quantities for bait, manure, oil and food. Frequently one hundred barrels are taken at one haul of the seine." The oil taken from these Fishes is largely used in out-door painting, being considered preferable to linseed oil. DeKay says the largest haul he has heard of numbered eighty-four wagon loads.

SHAD (*Alosa sapidissima* (*Wilson*), *Storer*).—This valuable Fish is found ranging from Newfoundland southward as far as Florida. Mitchill says it comes regularly from the ocean and visits us at New York in an annual migration, about the end of March, ascending towards the sources of the Hudson and other rivers to breed. It usually weighs about four or five pounds, but has been taken as heavy as twelve pounds. Smith says: "It bears so much resemblance to the Herring as to be called 'The Mother of Herring.' The Shad Fishery of the Connecticut River has been a source of great wealth between Saybrook and Hartford. The Merrimack, Medford, Connecticut and Neponset rivers are among the principal ones in which this Fish is taken in such quantities as to make it an object of pecuniary interest." DeKay figures and describes this species as THE AMERICAN SHAD (Alosa præstabilis), and characterizes it as the "largest American species of the genus; length, one to two feet." He adds: "This beautiful and savory Fish has been confounded with the Shad of Europe. The A. vulgaris, or Allice Shad of Yarrell, is more like ours in size and flavor. Unlike most of the genus which come to us from the Northern seas, this species appears from the south to deposit its spawn. In Charleston, S. C., they come in January or February; later at Norfolk; and here the latter end of March or first of April, their appearance being accelerated or retarded by the mildness or severity of the season; on the coast of Massachusetts they appear in May, and farther north they have been observed still later." There are several varieties. On the coast of Carolina the fat ones have the tail swollen, and are called *Club-tails*. Formerly a large variety was taken in the Hudson River called *Yellow-backs*. Those which ascend the Connecticut are more cylindrical in body, and are considered a better quality. The Shad that enter the Hudson are known to spawn one hundred and fifty miles from its mouth. They are called *Back Shad* when they are returning about the end of May, and are then lean and poor eating. Dr. Storer records: "The quantities of Shad taken in Charles River, Mass., at Watertown, for the five years preceding 1838, averaged about six thousand per annum. From three thousand to four thousand are yearly caught at Taunton. About the first of this century this Fish was very scarce in the Merrimack River, and remained so for about five years; previous to that time they had been very abundant. After the scarcity they became again abundant, and continued so until about the year 1810, when they were again scarce for a few years. They then became plentiful, and still remain so." In many streams these Fish are entirely cut off by dams and noxious factories. The Shad is not esteemed as food when taken in salt-water. Ausonius referred to this state when, as we have seen in our account of the family, he despised it as the "poor man's food." In the region of New York, and probably in various parts of Europe, the various species of Shad are regarded as very superior food. In New England, where the salt-water Fishes are much better flavored than in the more Southern waters, the Shad is not really popular. Especially is this so east of Boston. It is ranked with the Alewife and Herring—too little for the picking.

THREAD HERRING (*Opisthonema thrissa*, *Gill*).—This species ranges from Newfoundland to Florida. It is known as MENHADEN in Portland, probably confounded with the Brevoortia. In New York it is called SHAD-HERRING and THREAD-FISH. DeKay says it appears in New York waters about the first of September. He records and figures it as SPOTTED-THREAD HERRING (Chalæssus signifer). Length, eight to ten inches. It is a beautiful form, the elegant shape of the dorsal fin being increased by the long filament which constitutes the last dorsal ray.

THE HERRING (*Pomolobus pseudoharengus* (*Wilson*), *Gill*).—Called ALEWIFE in New England; GASPEREAU in the British Provinces; SPRING HERRING, KYACK, BLUE-BACK, SAW-BELLY, and CAT-THRESHER in Maine. The Narragansets called it AUMSUOG. It has a range from Newfoundland to Florida. Pennant and others conceived the notion that Herring rendezvous in winter in the Arctic circle, where they continue several months in order to recruit themselves with the abundance of food they find there, after the exhaustion of spawning. They begin to appear off the Shetland Islands in April and May, but the grand shoal is not seen until June. The main body is described as altering the appearance of the very ocean. It is divided into distinct columns of five or six miles in length, and three or four in breadth, and drives the water before it with a kind of rippling. Sometimes it sinks for a few minutes, and then rises again to the surface. The Shetland Islands form the first check, and divide it into two parts; then, pursuing its way down the coasts, it enters every bay or inlet on either side, even as far as the coast of France. Pennant, quoting from Catesby, says of the American Herring: "They leave the salt-water in March and run up the rivers of Carolina in such numbers that the inhabitants fling them ashore by shovels full; passengers trample them under feet in fording streams." Mitchill describes this species as SPRING HERRING, or ALEWIFE (Clupea vernalis). He says: "We are informed that this very species of Fish used to spawn in Crumpond, a source of the Peekskill, and in Lake Otsego, at the head of the Susquehannah, but has discontinued on account of dams and other obstructions." Mitchill was a representative to the Assembly at Albany in 1810, when a project was on foot for damming the Hudson River near Troy, to facilitate navigation above. He made strenuous efforts to defeat it, considering himself an "advocate for the Fish, and begged the House to view him as counsel for their silent tribes. Like St. Antonio he felt a deep concern for their welfare." The scheme was negatived.

The word *Alewife* is thought to have been derived from the Indian word *aloof*—signifying a bony Fish. DeKay records it as the AMERICAN ALEWIFE (Alosa tyrannus). This Fish appears in great quantities in Chesapeake Bay from March until May, and in New York waters about the 1st of April. In Massachusetts the Taunton River is a notable place for the Alewife, from April to June. Here, as well as in other streams, a great falling off is noticed in the numbers on account of the erection of dams.

TAILOR HERRING (*Pomolobus mediocris* (*Mitch.*), *Gill*).—Known by this name in the Potomac River, and as FALL SHAD in other localities. Its range of habitat is from Newfoundland to Florida. Mitchill described it as the STATEN ISLAND HERRING (Clupea mediocris), and remarks that it "grows very large for a Herring, being frequently eighteen inches long." He also describes the same Fish as another species, which he calls LONG ISLAND HERRING (C. mattowaca). Of the latter he says: "It is caught mostly in autumn, and brought to market with the fall running of Striped Perch or Rock-fish. In October and November the present Fish is taken in seines off the surf side of the beaches fronting Long Island. Some call it Shad Herring and some Fall Shad." DeKay figures and describes it as the AUTUMNAL HERRING.

ENGLISH HERRING (*Clupea harengus, Linn.*)—Range from the Polar regions to Cape Cod. DeKay and other writers distinctly claim that the American Herring is a different species from the English. In Gill's *Fishes of the East Coast*, the present one only is named, and it is to be presumed that the more careful study of the family and its species has resulted not only in finding the English and American identical, but also several smaller forms which were described as separate species by DeKay and Storer. DeKay describes the species as the COMMON AMERICAN HERRING (Clupea elongata). He says it rarely descends to the New York coast, but is occasionally taken in the waters at the south of Cape Cod. The seeming capriciousness of this and other species in visiting or deserting the coast or particular localities, is the subject of much absurd writing. This species, according to DeKay, first made its appearance in Long Island Sound in 1817. At the time of the attack on Stonington, in 1814, these Fishes were supposed to have followed the squadron from England! Storer records as follows: "THE COMMON AMERICAN HERRING (C. elongata, Leseur), incorrectly called by our fishermen 'English Herring,' is taken in great numbers on some parts of our coast. At Edgartown it is abundant from March to May." It is sold mostly for bait. "Until within the last twenty years," says Dr. Storer, writing in 1857, "this species was exceedingly abundant at Cape Cod. It came into Massachusetts Bay and Provincetown Harbor in myriads, from about the 20th of March to the 1st of April, and continued there until June, and would then leave the coast and not be seen again until the autumn. Now it has become so rare that at some seasons it is scarcely seen at all. Within the last few years it is perhaps slightly increasing." The young are called *Spirling*, and serve as excellent bait for Cod-fish, being taken in nets which are about forty yards long and fifteen feet deep, with meshes an inch and a half across. In different parts of Massachusetts Bay the Herring are taken by "torching." Several varieties of this genus are well-known luxuries in England. The celebrated Whitebait, long the subject of controversy, is now definitely proved to be the young of Herring. Mr. Eugene Blackford, of Fulton Market, New York, imported a lot of the English Whitebait, and, after close comparison with the young of our Herring by Prof. Baird, the identity of the two was made certain. In the spring of 1878, Whitebait were taken off Bay Ridge, New York Harbor, which were also determined to be the same species. Young Whitebait were kept in Brighton Aquarium until they were grown to be twelve inches in length.

FAMILY—DOROSOMIDÆ.

One genus only is embraced in this family, having one species known to our waters.

TOOTHED HERRING (*Dorosoma cepedianum* (*Lac.*), *Gill*).—Ranges from Cape Cod to Hatteras. DeKay records species Chatessus cepedianus as inhabiting Chesapeake Bay.

FAMILY—ENGRAULIDÆ.

ANCHOVY (*Engraulus vittatus* (*Mitch.*), *Baird and Girard*).—Has a range from Cape Cod southwards. Mitchill recorded it as "SATIN-STRIPED HERRING (Clupea vittata). Length about three inches and a half; depth, a little over half an inch. Inhabits the salt-water and resembles an Atherine." The English Anchovy (E. vulgaris, Cuvier) was well known to the Greeks and Romans, by whom the liquor prepared from it, called *garum*, was in great estimation. The fishery of the Anchovy is referred to by Ælian, who says that on one occasion so large a school was taken that fifty fishing boats were loaded with the produce. Oppian adopts the poetical exaggerations of the time, and refers the great numbers of these Fishes as originating from the froth of the sea. Engraulus browni (Gmelin), Val., is another species, with the same range as the preceding.

FAMILY—SILURIDÆ.

This family derives its name from the European Cat-fish (Silurus). The body of these Fishes is moderately elongated and tapers backwards from behind the shoulders. The skin is naked. The dorsal fin is near the head; the anal fin is rather large. This is a very large family, embracing quite an hundred genera, and nearly seven hundred species. "Most species are found in the fresh-water lakes and rivers. The species, so far as is known, take care of their young, and peculiar provision is made for the protection of the eggs in the mouth of several genera found in tropical waters."—*Gill.*

FORK-TAILED CAT-FISH (*Ælurichthys marinus* (*Mitch.*), *Baird and Girard*).—Ranges from Cape Cod southwards. Mitchill described this Fish as the "SALT-WATER CAT-FISH (Silurus marinus); a splen-

did Fish, twenty inches long, and exquisite for eating." DeKay describes and figures it as "THE OCEANIC CAT-FISH (Galeichthys marinus). It has a wide geographical range, having been found in the Atlantic from 20° south to 41° north, along the shores of the two Americas." It swims with its long dorsal above the surface in the manner of Sharks, and is said to imitate those creatures in voracity.

SEA CAT-FISH (*Ariopsis milberti* (*Val.*), *Gill*).—The range of this Fish is from Cape Cod southwards. DeKay names it MILBERT'S ARIUS (Arius milberti).

FAMILY—CONGRIDÆ.

This group has been separated, to form a family, from the *Anguillidæ*. One genus only is included among our native Fishes. DeKay gives the characteristics of the genus Conger as consisting of even jaws; the dorsal fin commencing above the pectorals, or a short distance behind them. The species are chiefly oceanic, and are further distinguished from Anguilla by the greater number of their vertebræ.

CONGER EEL (*Conger oceanica* (*Mitchill*), *Gill*).—Ranges from Newfoundland to the West Indies. Mitchill described this Eel as Anguilla conger. His specimen was thirty-seven inches in length and seven and a half inches in girth, weighing nearly four pounds. He says the "flesh is white and very dainty eating," an opinion not entertained by others, who regard it as exceedingly disagreeable. DeKay says: "The flesh has a peculiar, unsavory taste. * * * The Conger Eel may be considered as rare on our coast. It is apparently a vicious animal, snapping, when captured, at everything near it." He names it THE AMERICAN CONGER (C. occidentalis). Of the English species, C. vulgaris, Couch, in *Fishes of the British Isles*, says: "It is one of the commonest Fishes that frequent the waters of the coast of the United Kingdom. This species is said to have been taken weighing one hundred pounds, and measuring ten feet in length. A strange diversity of opinion concerning its value as food exists here as well as in America. In Scotland it is despised, while in some portions of the west of England it is valued and made an important article of trade. In the fourteenth century it was prized by the nobility, and was reserved as a chief rent in the underletting of land. * * * A special preparation of this Fish formed an established trade in the west of England in the time of King John. Following the example of his Norman predecessors, at the small price of six marks he assigned to certain merchants of Bayonne the monopoly of the right of drying Congers and Hakes. This preparation was what was called *Conger doust* (Sweet Conger), the exportation of which was to Spain." The Conger is exceedingly tenacious of life. An example is related by Yarrell of one that exhibited perfect vigor after being ten hours out of water. Among the various differences seen, on comparing the Conger with the common fresh-water Eels, is the unequal number of vertebræ; in the latter there are one hundred and sixteen, in the Conger one hundred and fifty-six. Plate 2, fig. 7.

FAMILY—ANGUILLIDÆ.

One genus only of our American East Coast Fishes is embraced in this family. The characters of Anguilla are seen in the dorsal fin commencing considerably behind the pectorals, and uniting with the anal to form the caudal fin. The lower jaw is the longer. The mouth has a row of teeth in each jaw, and a few on the anterior part of the vomer.

COMMON EEL (*Anguilla bostoniensis* (*Leseur*), *DeKay*).—Ranges from Newfoundland to Hatteras. Gill records this as the sole species, from which we infer that the various forms described by other authors are identical with the present. Mitchill figures and describes THE COMMON EEL (A. vulgaris); DeKay records it as THE COMMON NEW YORK EEL (A. tenuirostris); Storer as THE COMMON EEL OF MASSACHUSETTS (A. bostoniensis). The Eel is taken on all parts of our Eastern coast, as well as in the rivers and ponds of the interior. In the spring and summer it is taken in large wicker baskets, called *Eel-pots*, and by torch-light, using the spear. The latter mode is also employed in winter, holes in the ice being made for that purpose.

FAMILY—SACCOPHARYNGIDÆ.

This family is thought to resemble the Anguillæ more than any other. The species are distinguished by the enormous head and mouth, and attenuated tail. The body is very long, but is not like the Eels. The abdominal portion is moderate in length, but the tail is greatly extended. The skin is lax and scaleless. The stomach is at times distended to such a degree as to give rise to the generic name. One species only is known.

GULPER (*Saccopharynx flagellum*, *Mitchill*).—Inhabits the open sea. Mitchill records it as found in latitude 52°, longitude 30°, west. Gill says the only known specimens were found far off the American coast and off Madeira. The color is black. Its peculiar proportions are thus stated: head, two and a half inches in length; trunk, six inches, and tail twenty-five inches.

FAMILY—ACIPENSERIDÆ.

This family is regarded as a very natural group, with no near relations in the present age. The skin is armed with minute bony plates, and five rows of keeled bucklers of larger size. Teeth are entirely wanting in the adult. The skeleton is cartilaginous. The air-bladder is large and simple, and communicates with the æsophagus through its upper surface. Species are found in all the temperate portions of the Northern hemisphere. They all breed in fresh-water, but some are residents of the sea part of the season, others are permanent residents in fresh-water lakes and rivers. Two primary types are recognized, —Acipenser and Scaphirynchops.

SHARP-NOSED STURGEON (*Acipenser oxyrhynchus*, *Mitchill*).—Gill records this as a doubtful species. Its range is from Cape Cod to Florida.

SHORT-NOSED STURGEON (*A. brevirostris*, *Leseur*).—Ranges from Cape Cod to Florida.

FAMILY—CEPHALOPTERIDÆ.

This family formerly found a place among the *Rays*. The genus Cephaloptera, which gives name to the group, has the pectorals produced into long processes at their anterior extremities, presenting the appearance of two horns, and this feature suggests the generic name, the processes bearing some resemblance to wings; hence, *wing-headed*. The teeth are slender, and the dorsal fin is small. The tail is slender, and armed with a serrated spine.

THE DEVIL-FISH (*Ceratoptera vampirus*, (*Mitch.*), *Gill*).—Ranges from Cape Cod southward to Florida. The generic term here used refers to the *horn shaped wings*. DeKay records it as Cephaloptera. Mitchill describes one that required three pair of oxen, aided by a horse and twenty-two men, to drag it to dry land. It was estimated to weigh between four and five tons. DeKay says: "It is known to seize the cables of small vessels at anchor. A schooner was seen suddenly to move across the harbor with great rapidity, impelled by some unknown and mysterious power. On reaching the opposite shore the course was changed so suddenly as to nearly capsize the vessel. These mysterious flights across the harbor were repeated several times, and suddenly ceased." The measurements given by DeKay are as follows: length to base of tail, ten feet; to the end of tail, sixteen feet; width across the pectorals, seventeen feet. We have seen this species in the Gulf of Mexico, seemingly feeding on small Fishes, like Herring, that were in immense shoals. There were several of those great sea vampires associated, about ten feet in width each. Their movements near the surface of the sea were such as to expose one of the large pectoral wings as they turned to follow the Fishes, their great bulk causing considerable commotion.

FAMILY—MYLIOBATIDÆ.

The genus Myliobatis is the typical one, giving rise to the name of this family. The union of the pectoral fins and the body renders it very broad by the lateral extension of the latter. The tail is very long and attenuated. The dorsal fin is developed near the root of the tail, behind which is one or a pair of spines, which are serrated on their lateral edges. There are no spines upon the skin.

BISHOP RAY (*Ætobatis narinari* (*Müll.*), *Henle.*)—Ranges, as far as known, from Virginia to Florida. It is called OBISPO in Cuba.

COW-NOSED RAY (*Rhinoptera quadriloba* (*Les.*). *Cuv.*)—Plate XI., fig. v.—This little Ray is found on our shores from Cape Cod to Florida. Several specimens in the New York Aquarium were taken in New York Bay, near Sandy Hook. They are exceedingly interesting, and very beautiful in form, color, and in their movements. The wing-like fins are worked like the wings of a bird.

SHARP-NOSED RAY (*Myliobatis fremenvillei* (*Les.*), *Storer*).—This ranges from Cape Cod to Florida. Storer figures it as M. actua, Ayres.

FAMILY—TRIGONIDÆ.

STING RAY (*Trygon centrura* (*Mitch.*), *Gill*).—Ranges from Cape Cod to Florida. In various portions of the coast it is called STING RAY, WHIP RAY and STINGAREE. Mitchill named and described it: "A very large species, found on the coast of Long Island, with a tail of five feet or more in length, covered all over with prickly shields or scales, and armed on its upper side with two naked bones of four inches long, inversely serrated." DeKay records it as WHIP STING RAY (Pastinaca hastata). Pliny treats of this species; the term Pastinaca being used to designate a form known to the early writers. Rondelet figures one which bears the name *Le Pastinaque*. Belon and others figure the same; all of them represented with a very large and long serrated spine at the base of the tail.

BUTTERFLY RAY (*Pteroplatea maclura* (*Müll.*) *and Henle*).—This species is found ranging from Cape Cod to Florida.

FAMILY—TORPEDINIDÆ.

This family derives its name from the typical genus, Torpedo, the ancient name of the species. The group is made up of *Sclachians*, of the order of *Rays*, and is notable for the electrical phenomena it exhibits. Concerning this feature, Gill says: "The electrical apparatus is situated between the head (eyes and spiracles) and the inner concealed bases of the pectorals; this is composed of numerous approximated hexagonal columns at right angles with the surface of the body, and with their ends often visible through the skin above and below, occupying, as the apparatus does, the entire depth between the upper and under surface of the body. These batteries are provided with nerves from the eighth pair. The shock is quite subject to the volition of the animal, and is used, probably, for offensive as well as defensive purposes. In ancient days the animal was impressed into use for medicinal purposes, and was the original electro-therapeutic medium." Dioscorides, the physician who attended Antony and Cleopatra, is said to have made use of its powers. The species are distributed throughout the warmer and temperate seas. About twenty species are known. The genus Torpedo is the only one represented in our waters.

TORPEDO (*Torpedo occidentalis, Storer*).—Ranges from Cape Cod to Florida. This singular Fish was for a long time unrecognized on our coast. Storer first described it. He says: "Dr. Mitchill introduced the Raia torpedo into his *Fishes of New York*, published in 1815, upon the authority of several fishermen with whom he had conversed, who had been electrified with a species of Ray when they were detaching it from the hook. He had never seen a specimen, but had no doubt of its being the Common Torpedo, and consequently catalogued it as such." Storer found no other notice of this Fish afterwards, by authors, but gathered testimony of the existence of such a form, which the fishermen called CRAMPFISH, that was occasionally found off Cape Cod. In

1842 he was fortunate in having a specimen sent to him from Wellfleet, where it was captured. It appears to have been met with only on the eastern shore of Cape Cod, for an extent of about thirty miles, between Provincetown and Orleans. On the eastern shore of Long Point, Provincetown, it is most common, but has been observed only in the months of September, October and November. About the year 1819 it was seen to be unusually common at Provincetown, from sixty to eighty being seen in a year. In 1846 Storer ascertained, during a visit to Martha's Vineyard, that it was taken in the waters around the shore south of Cape Cod. A living specimen, weighing about sixty pounds, was brought to Boston by Capt. Atwood. This specimen was examined by Drs. Storer and Jackson. The shock was scarcely perceptible while the Fish was lying on deck, quiet. On taking it by the tail, and with the other hand placed on the portion of the pectoral fins which is supplied with the nerves from the fifth pair, quite a shock was perceived in the arms as high as the elbows. Capt. Atwood, a most reliable and intelligent observer, asserts that he has "received a great many shocks which have thrown him upon the ground as quick as if he had been knocked down with an axe." He has "also received shocks by taking hold of the pole of a harpoon when at the distance of eight feet from the Fish. Also has felt the numbness while holding the rope attached to the harpoon." Even when cutting the Fish the fingers would be so affected that he with difficulty grasped the handle of the knife. The largest specimens of Torpedo found in our waters weigh nearly two hundred pounds. The liver of this Fish yields, in the largest, about three gallons of oil, which is regarded as of superior quality for burning. Belon figures a species which he names *La Tremble*, or *La Torpille;* in Greek, *Narce*. The Romans called it *Ochiatella*. Rondelet presents a rude figure with the same nomenclature.

FAMILY—RAIAIDÆ.

This group derives its family name from the Ray; Latin, *raia*. This term is said to be from the Anglo-Saxon, *reoh*, meaning rough, many of the species having a rough skin. The Rays are all remarkable and characteristic in shape. The immense development of the pectoral fins, which form a wide, salient angle at the sides, run forward, completely enveloping the head, and for the most part forming a long conical projection in front of it; the other fins are insignificant and are generally placed on the tail; the latter being armed with strong spines. The female is oviparous, laying eggs enveloped in a greenish, rectangular-shaped parchment case, having four filaments that readily become entwined in sea-weed or floating debris. These eggs are known among fishermen as "sailor's purses," and are quite common on the sea beaches. Between thirty and forty species are known.

CLEAR-NOSED RAY (*Raia eglanteria* (*Lac.*), *Leseur*).—Has a range from Nova Scotia to Florida. Mitchill has described it as R. diaphanes and as R. ocellata. Storer and DeKay retain the first name of Mitchill. This Ray is exceedingly common in the waters near Nahant, and attains the length of three feet. Rondelet and Belon figure several species, and, also, the curious egg case.

SUMMER SKATE (*R. erinaceus, Mitch.*)—This is recorded by Gill as a doubtful species. Its range is from Cape Cod southward. Mitchill described it, and DeKay records it as THE HEDGEHOG RAY, the specific name referring to its spiny or Hedgehog appearance.

SHARP-NOSED SKATE (*R. lævis, Mitch.*)—Called, also, WINTER SKATE. Habitat, from Nova Scotia to Florida. This is described by Mitchill as THE SMOOTH SKATE. DeKay says: "It is an exceedingly common species in the autumn about New York. With its powerful spade-like snout it roots up clams and crushes them between its flattened teeth, which appear to act upon each other like the cylinders of a rolling mill." This Ray is very common in Massachusetts Bay, where it attains the length of from two to five feet.

FAMILY—PRISTIDÆ.

This family has the characteristics of the Sharks and Rays combined. The snout is prolonged into a flat appendage, armed on each side with a row of sharp, spine-like teeth.

SAW-FISH (*Pristis antiquorum* (*Linn.*), *Lath.*)—Plate XI., fig. viii.—Ranges from Cape Cod southward. This remarkable Fish attains the length of fifteen feet. DeKay says he has never met with an undoubted specimen from our coast, and quotes Schœpff, who says: "An individual was captured at New York in July, 1782. It was fifteen feet long, including the saw." The Saw-fish is common among the keys of the Florida Reef. Belon figures the saw-shaped snout. Rondelet figures a Saw-fish in the form of a Cetacean, with horizontal tail, whale-like pectorals, and a blow-hole through which the stream of water is represented coming forth in a column. In short, it is a figure of a Whale with the proper saw development of a Saw-fish; it is also classed with the Whales, and is named *La Vivelle*.

FAMILY—SQUATINIDÆ.

Of this family, only one genus with one species is represented in American waters.

ANGEL-FISH; SHARK-RAY (*Squatina dumerili, Leseur*).—The excessive ugliness of this Fish is the cause of its principal trivial designation. It is also called in Europe MONK-FISH, or MONKEY-FISH, KINGSTON and FIDDLE-FISH, from its shape. In New York it is known as LITTLE BULL-HEAD SHARK. Its range is from Cape Cod to Florida. The shagreen of this species has long been used for polishing wood. Aristotle speaks of it with reference to this use. Belon and Rondelet figure it, the latter under the name *Lange*. Gill regards this American species as uncertain. DeKay figures it as the "AMERICAN ANGEL-FISH. Length, three to four feet. Very rare." In England this Fish is named "Mongrel Skate," where it attains the length of ten feet. Plate 16, fig. 78.

FAMILY—CETORHINIDÆ.

One genus only of American forms, with one species, is embraced in this family, which was formerly included in the *Squalidæ*. The characters are as follows: Branchial apertures are all before the pectorals, long, and nearly surrounding the neck; teeth small, not denticulated, of various forms, and for the most part conical. The tail has a carina on each side.

BASKING SHARK (*Cetorhinus maximus, Blain*).—Gill records this as doubtful as to species, having a range from Newfoundland to Hatteras. It is named, also, SUN-FISH, SAIL-FISH and HOE-MOTHER in Great Britain. Mitchill mentions the species as "a Shark of huge size, taken in considerable numbers near Provincetown, Cape Cod, for the oil of the liver; remarkable for having something in the mouth resembling the horny substance called whalebone, which has led to its being called Bone Shark." DeKay records: "This Shark inhabits the Northern seas, and occasionally visits our coast in summer. His large size, and his habit of swimming near the surface, with his upper jaw projected out of the water, has suggested to ignorant credulity the idea of some huge monster, which has received the name of Sea Serpent." It has received its name from the habit of basking or lying quiet in one place for a length of time. Sluggish in habit, it has none of the ferocity attributed to other species. One taken near New York measured twenty-eight feet in length and sixteen feet in circumference. DeKay says it attains the length of thirty-three feet. Storer says of this Shark: "The Basking or Elephant-shark; length, thirty-six feet. Among our fishermen this is known as Bone Shark. It is rarely known on our coast, and when taken is usually harpooned." Capt. Atwood had met with only three specimens, one of which had drifted ashore in a state of decomposition. A fisherman visited the latter for the purpose of procuring a slice for his hens, as is the custom at Provincetown, supposing it to be a dead Whale. Ascertaining what the animal was, he removed the liver and sold the oil (five or six barrels) in Boston for one hundred and three dollars. In 1848 quite a number of these Sharks were met with off Cape Elizabeth, near the coast of Maine, and several were secured. A tradition exists among the eastern fishermen that about one hundred years ago the Basking Shark was taken in considerable numbers for the oil. In Storer's figure of this Fish the features are very singular and striking. The nose is blunt; the gill openings exceedingly long, occupying nearly the whole depth of the shoulders, and the tail is large and curiously winged at the extremity. Yarrell figures this Fish, and says that it is called Sun-fish on the Welsh and Irish coasts, from the fact that it lies on the surface of the water, nearly motionless, in the sun for a considerable length of time. This writer says that the largest specimen he has seen was taken off Brighton, and measured thirty-six feet in length. The term Sail-fish is derived from the fact that the creature swims listlessly along the surface, exposing its dorsal fin like a sail above water. In Orkney it is called *Hoe-mother*, and by contraction *Homer*—that is, the Mother of the Picked Dog-fish, which is there called *Hoe*. The Basking Shark has teeth in unusually small proportion to its size. Linnæus says that its food is Medusæ, and Pennant considered that it subsisted on marine plants.

FAMILY—LAMNIDÆ.

The body is fusiform; the lower lobe of the caudal fin is a little smaller than the upper; the tail has a keel on each side; two dorsal fins, the first behind the pectorals; the head is pointed in the snout; the mouth large and inferior; teeth large; the nostrils not confluent with the mouth; the spiracles obsolete or entirely wanting; the branchial apertures very wide. This includes the Mackerel-shark and the Man-eater of American waters. The family was well represented in past geological epochs, and enormous teeth of Carcharodon are found in tertiary beds. The phosphate beds in South Carolina have yielded great numbers of remains of these enormous Sharks. The collection made by Prof. Holmes, of Charleston, is in the American Museum, Central Park, New York, and exhibits the most remarkable series of these remains yet found. Several of the teeth of the fossil and extinct Carcharodon are fully as large as the outspread human hand, and retain the enamel in a perfectly natural condition.

MACKEREL-SHARK (*Isuropsis dekayi, Gill*).—Called in Cuba, DENTUDA. Ranges from Newfoundland to Florida. Recorded as doubtful as to species by Gill. DeKay describes this as the MACKEREL-PORBEAGLE (Lamna punctata), length, ten feet two inches. This was an unusually large specimen, taken in the harbor of New York in 1840. The species received its name from being frequently seen in pursuit of Mackerel. Its liver produces a large quantity of oil, which is highly esteemed by curriers. Storer says it weighs between two and four hundred pounds, measures from three to ten feet, and is the most common species found in the Massachusetts waters, being met with during summer and autumn, when it annoys the fishermen greatly by biting off their lines while fishing for Cod. This Shark is also frequently entangled in nets set for Mackerel and Menhaden, producing thereby much annoyance and ruin. On the coast of Maine it is particularly abundant during the warmer season. The Porbeagle of English waters, closely allied to the present species, is said to have derived its name from the fact that it hunts in small companies, like a pack of dogs, and also from its distant resemblance to the Porpoise. The Mackerel-shark is very comely in shape, and resembles the Mackerel in form.

ATWOOD'S SHARK (*Carcharodon atwoodi* (*Storer*), *Gill*).—Called, also, the MAN-EATER. Ranges from Newfoundland to Florida. Storer described this as THE MAN-EATER (Carcharias atwoodi), length thirteen feet, and an exceedingly rare species. The specimen referred to was captured in Provincetown Harbor, and in this instance furnishes an authentic example of the ferocity of this kind of Shark. The creature was followed by a harpooner, who drove his

instrument into him; "the Shark instantly turned towards the boat, and seized it with great ferocity near the bows, in which act several of the teeth were broken off. It was eventually killed by being frequently lanced."

FAMILY—ODONTASPIDIDÆ.

The term Odontaspis, meaning "tooth" and "buckler," is applied to the typical genus; hence the family designation. The forms here embraced are most nearly related to the Mackerel-sharks. The body is, however, more like the ordinary Sharks in shape, the tail being prolonged greatly backwards. The head is depressed, oval, and has a pointed snout. There is no nictitating membrane. The nostrils are simple, and situated away from the mouth, which has a wide gap. The teeth are nail-like, with small cusps at the base, in each jaw. The opercular apertures are five in number, before the pectorals. Considerably behind the eyes are minute spiracles. There are two dorsal fins, the first in advance of the ventrals, the second partly anterior to the anal; the caudal fin has a small inferior lobe. There are no pits or keels at the root of the tail. According to Gill, there are not more than two living species known, one of which is Mediterranean.

SHOVEL-NOSE SHARK (*Eugomphodus littoralis, Gill*).—Ranges from Maine to Cape Hatteras. Called, also, SAND SHARK. Mitchill described a Shark with the characters which belong to this genus, and named it LONG-TOOTHED SEA SHARK (Squalus americanus). He says: "This Fish is occasionally taken at the very city of New York. The teeth of this species are found abundantly in the alluvial country of North America. The long narrow tooth almost resembles a horseshoe nail with its two little auxiliaries at the base." This is probably identical with the present.

FAMILY—ALOPECIIDÆ.

The term *alopecias* is used by Pliny to indicate a Sea-fox—a kind of Fish. The exceptionally long tail of the species is the principal character.

FOX-SHARK; THRESHER (*Alopias vulpes* (*Linn.*), *Bon.*)—Plate XI, fig. vii.—Called, also, SWINGLE-TAIL, SEA-FOX, SEA-APE; PER ZORRO in Cuba, and PESCE PAVONE in Naples. Ranges from Cape Cod to Florida. Mitchill described it as LONG-TAILED SHARK (Squalus vulpes), his specimen being thirteen feet in length. DeKay describes it as THE THRESHER SHARK (Carcharias vulpes), and says: "The species has been noticed on our coast from Nova Scotia to New York." Storer records it as the same, and puts the length at from twelve to fifteen feet. We have heard of one being caught at Nahant which measured twenty feet. It is frequently caught in seines in Massachusetts Bay. The tail of this species is fully one half the total length.

FAMILY—SPHYRNIDÆ.

HAMMER-HEAD SHARK (*Sphyrna zygæna* (*Linn.*) *Müll. and Henle*)—Plate XI, fig. vi.—Called CORNUDA in Cuba. Ranges from Cape Cod southward. Mitchill says the voracity of this animal may be judged of from the following occurrence at Sag Harbor, in September, 1805: "Three Sharks of the Shovel-nose species were taken in a net by Mr. Joshua Terry. The largest was eleven feet in length. On opening him, many detached parts of a man were found in his belly, with portions of clothing." DeKay says: "It is much dreaded by our fishermen for its boldness and ferocity. I have seen them in Hell Gate, four feet long." The Hammer-head is found on both sides of the Atlantic. It ranges from the coast of Brazil northwards, but is not seen above Cape Cod.

SHOVEL-HEAD SHARK (*Reniceps tiburo* (*Linn.*), *Gill*).—This is a species little known, having the same range as the preceding.

FAMILY—GALEORHINIDÆ.

This family derives its name from the term *galeos*, meaning a "ravenous Sea-fish," or a "Weasel-fish."

BLUE SHARK (*Eulamia milberti* (*Müll. and Henle*), *Gill*).—Ranges from Cape Cod to Florida. DeKay records the SMALL BLUE SHARK (Carcharias cerulens), and says: "This species is frequently taken in our waters, and along the coast to New Hampshire. I should be inclined to consider this and the obscurus of Leseur as identical, were it not for the teeth, which he represents in his plate as having rounded shoulders. They are at all events closely allied species." As Gill does not record another, but gives the obscurus as distinct, we presume that the present species and C. cerulens are identical.

DUSKY SHARK (*E. obscurus* (*Leseur*), *Gill*).—Ranges from Cape Cod southward. DeKay named this Carcharias obscurus; Leseur, the Squalus obscurus. Storer describes a specimen captured at Nahant, in 1839, which measured nine and a half feet. He says it is not a common species in Massachusetts Bay, but sometimes floats ashore in the night, like the Lophius, or Goose-fish, or becomes entangled in the Mackerel nets. Aprionodon punctatus (Mitch.), Gill, ranges from Cape Cod southward.

TIGER-SHARK (*Galeocerdo tigrinus* (*Müll. and Henle*).—Ranges from Cape Cod southward. Called ALECRIU in Cuba.

SMOOTH HOUND (*Mustelus canis* (*Mitch.*), *DeKay*).—Called by the above name in Great Britain; and in Massachusetts, SMOOTH DOG-FISH and BLUE-DOG. DeKay calls it THE AMERICAN HOUND-FISH. In Cuba it is BOCA DULCE. Ranges from Cape Cod to Hatteras. Mitchill described it as DOG-FISH (Squalus canis), and measuring sometimes four feet in length.

FAMILY—SPINACIDÆ.

The typical genus, Spinax, giving name to the family has the branchial apertures, five in number, all in advance of the pectorals. The spiracle behind the eye is large. There are two dorsal fins, each with a spine in front, the first more or less behind the pectorals, the second near the caudal; the ventral fins are far behind; the anal is absent. Several genera are known in various parts of the world; two only, however, are found in our waters. "The European

species (M. vulgaris)," says Mr. Yarrell, "is the most common of all the Sharks. It is affirmed that, on the coast of Cornwall, as many as 20,000 have been taken in a net at one time. This Fish bends itself into the form of a bow for the purpose of using its spines, and, by a sudden motion, causes them to spring asunder in opposite directions; and so accurately is this intention effected that, if a finger be placed on its head, it will strike it without piercing its own skin. This Fish is subject to occasional monstrosity. A friend has one with two heads, the separation continuing as far back as the pectorals." Belon figures *Chien de Mer*, which is a tolerably good illustration of the Dog-fish. He also figures two species of *Galeus*. One other he calls *Galeus hinnulus*, or *Nissole*, a species of *Chien de Mer;* and yet another form he names *Acanthus*, or *Spinax*. Rondelet records, with crude wood-cuts, *Milandre—Galeus canis* of Pliny, *Lamiola* of the Romans. Another he names *Chien de Mer estellé*, or in Greek, *Asterias galeus*. *Galeus glaucus*, or *Chien de Mer bleu*, resembles the Lamna of our waters. Excellent figures of the egg-cases are given by Rondelet.

PICKED DOG-FISH (*Squalus americanus* (*Storer*), *Gill*).—Called, also, BONE-DOG, SKITTLE-DOG, and HOE in Great Britain. It ranges from Newfoundland to Cape Hatteras. Storer and DeKay record this Fish as Spinax acanthias, and the former, later, as Acanthias americanus. It measures from one to three feet long, and is caught in immense numbers in Massachusetts Bay, in the spring and autumn, for the sake of its oil, which is used by tanners and currriers. A species, found in Greenland waters, is named Centrocyllium fabrici (Reinh.), Müller and Henle.

FAMILY—SCYMNIDÆ.

Scymnus is the name of the typical genus, and gives name to the family. The characters are seen in the absence of the anal fin and the round dorsals. There are two dorsal fins, the first situated in advance of the ventrals, the second far behind. The family embraces genera Scymnus, Somniosus, and three others found in the Mediterranean Sea.

NURSE; SLEEPER (*Somniosus microcephalus* (*Bloch*), *Gill*).—Found from the Polar regions to Cape Cod. DeKay described this species as Scymnus brevipinna, and remarks that Leseur described it from a stuffed specimen he saw in Marblehead. It has been regarded as very rare, and Dr. Storer records some instances of its capture on the New England coast, one in 1846, and again in 1848, and he adds: "I have learned, from conversation with intelligent fishermen, that individuals are captured every winter." It is sometimes seen to measure twenty feet in length. At Cape Cod it is called GURRY or GROUND SHARK. About the year 1843 the author examined a specimen brought ashore at Swampscott Beach, of which he took accurate measurements and drawings. These he presented to Prof. Agassiz of Cambridge, who, at that time, had not seen the species in our waters. Gill records it as doubtful as to species.

FAMILY—PETROMYZONTIDÆ.

From two Greek words, meaning *stone*, and *to suck;* hence, *Stone-suckers*. This family comprises all of the order *Hyperoartii*. The form is eel-like; the skin naked; eyes well developed; mouth with a subcircular, suctorial disk, armed with teeth which are horny, and sessile on soft papillæ. The branchial apertures are always seven in number, and lateral. The dorsal, anal and caudal fins are represented to a greater or less extent by a continuous or interrupted membrane; the pectorals and ventrals not developed. The intestine has a spiral valve. These are the characters of the adults, but all undergo a metamorphosis; and a very different form is seen in the young or larvæ. The term Ammocœtes was formerly used to distinguish these immature forms, under the impression that they were adult beings. In this larval state, the region before the branchiæ is little developed, and the eyes are absent; the mouth is represented by a mere longitudinal slit, without teeth. The species are represented in temperate portions of both northern and southern hemispheres. In a degree the species are parasitic, fastening themselves to other Fishes, whose flesh they consume by abrasion—differing in this respect from the Echeneis or Remora, which simply adhere for companionship. See, also, vol. ii., p. 111, and Plate 1, fig. 2.

LAMPREY; LAMPER-EEL (*Petromyzon americanus, Leseur*).—Ranges from Cape Cod to Hatteras. Gill records this as doubtful as regards the identification of species. Mitchill described it as the same as the European species (P. marinus). Storer remarks that it is occasionally taken in Massachusetts Bay, attached to pieces of drift-wood and the bottoms of boats and larger vessels. In the Merrimack River, at Lowell, they are taken in large quantities. During the spawning season they ascend the rivers a little earlier than the Shad, moving mostly in the night. Not being seen to return, the fishermen imagine they die. During summer they are often seen in pairs, at work together, constructing a mound, about three feet in diameter at the base and two feet high, composed of stones from the size of an ounce bullet to that of the Fish. DeKay describes it as "THE AMERICAN SEA LAMPREY, thirty inches long, and very different in its dentition from P. marinus of Europe. The Sea Lamprey is commonly taken in our bays and salt-water streams about the month of April, and, judging by the prices at which they are sold, must be held in high estimation by epicures. I have observed them at Albany in the spring, and was assured that they were taken a few miles below that city."

BLACK LAMPREY (*Ammocœtes nigricans* (*Leseur*), *Gill*).—Ranges from Cape Cod to Hatteras. Gill has it doubtful as to species. DeKay records it as BLUISH SEA LAMPREY (Petromyzon). Storer says it is frequently attached to Mackerel and other Fishes.

THE SMALL LAMPREY (*A. appendix* (*DeKay*), *Gill*) has a similar range, and is also doubtful as to species. DeKay first obtained it from Providence, R. I., and afterwards from the Hudson River. A. bicolor, Leseur, is another species.

FAMILY—MYXINIDÆ.

Named from the typical genus, Myxine. The species are long and slim, naked and slimy, having six branchial sacs on each side. Prof. F. W. Putnam, an American naturalist, regards the varieties as belonging truly to one species. "The eggs, from ten to eighteen in number, are comparatively very large. When deposited they are encased in an elongated, oval, hairy shell, provided at each end with a tassel of tubular filaments." They prefer muddy bottoms, and feed mostly upon dead animal matter.

HOG-FISH (*Myxine glutinosa, Linn.*), called, also, SUCKER and SLIME-FISH, is found from the Polar regions to Cape Cod. Gill records it as not definitely settled as to species.

FAMILY—BRANCHIOSTOMIDÆ.

Although included by Gill in his *East Coast Fishes*, this family is now referred to a separate class, which has been named *Leptocardia*. It is the lowest class of vertebrates. The family embraces but one genus. The species are yet in doubtful relations; one only is known to our coast. Representatives are found in European waters, in India, and on the coast of South America. This form is supposed to be a relic or surviving type of an ancient class, which was probably very plentiful in the distant past. The brain is exceedingly simple, not lobed largely as in other vertebrates. The skull is undeveloped, and there are no rudiments of an auditory apparatus. The skeleton is represented by a simple notochord, or embryonic backbone, which is not divided into vertebræ, and has no ribs or other appendages. The circulating system is very simple, the heart being simply tubular, and not divided into distinct chambers; hence the name of the class, *Slender-hearted.*

LANCELET (*Branchiostoma caribæum, Sundevall*).—Found from Hatteras southward. Amphioxus (sharp at both ends) was the generic term formerly applied to this species. Little is known of the habits, but the position of it in the system of nature is exceedingly interesting. Dorpat, Ray, Huxley and Lankester have recorded very much that is valuable and new concerning its anatomy. Prof. G. Browne Goode dredged some specimens of the Amphioxus in Bermuda waters, which were found embedded in sand.

FISHES OF THE FRESH-WATER STREAMS AND LAKES.

FAMILY ETHEOSTOMIDÆ (*Darters*) are small Fresh-water Fishes, closely allied to the Perches. The two dorsal fins are usually connected by a membrane at the base, the second dorsal standing high, and with considerable breadth; both dorsals are flanked with one or two sharp spines. The most brilliantly colored fresh-water Fishes are of this group. There are ten genera and about thirty species; all found in the United States and Mexico, east of the Rocky Mountains. It is said that all of the genera may be found in the same stream in some portions of the Mississippi Valley. The habit of many of this family is to prefer clear-running water, lying on the bottom, concealed under the stones. They are never seen floating or swimming leisurely, as most other Fishes do, but, when disturbed, they dart forth from the hiding-place with a quick stroke of their powerful wide pectoral fins, and as suddenly halt and settle down again, resting upon the extended ventrals and anal.

LEAST DARTER (*Microperca punctulata, Putnam*).—A small greenish-olive species, found in the Western and Southern States. Length, one and a quarter inches. FAN-TAILED DARTER (Catonotus flabellatus, Putnam), found in the great lakes and streams from New York southward and westward; an abundant species. STRIPED DARTER (C. lineolatus) is from the same localities and northward. TROUT-DARTER, or BLUE-BREASTED DARTER (Nothonotus niger, Jordon) is regarded as one of the handsomest of native Fishes, and inhabits the waters of the Ohio Valley; length, two and one-half inches. DOTTED DARTER (N. punctulatus), found in Missouri and Arkansas. BLUE DARTER (Poecilichthys ceruleus, Agassiz), called RAINBOW-FISH and BLUE JOHNNY, is abundant in the Mississippi Valley, and is the most brilliantly colored of all. Other species are: P. spectabilis and P. zonalis, inhabiting Indiana and Tennessee; FUSIFORM DARTER (Boleichthys fusiformis, Jordon), found in the Charles River, Massachusetts. Other species are: B. erochrons (red-sided), New Jersey, and B. exilis, Girard (slender-sided), abundant in clear brooks in the North-western States. SAND DARTER (Pleurolepis pellucidus, Ag.) inhabits the sandy streams of the Ohio Valley. This is regarded as one of the most interesting of our Fishes. It has a habit of plunging bodily into the soft, sandy bottom, where it lies indefinitely, with snout and eyes only visible. We have witnessed this curious habit of seclusion in the New York Aquarium. TESSELLATED DARTER (Bolosoma olmstedi, Ag.); abundant from New England to Wisconsin. A variety, called atromaculata, is known. B. effulgens (Little Johnny or Slim Darter) is abundant in the Eastern States and west of the Alleghanies. Etheostoma (Black-sided Darters). Three species are recorded under this genus. One found in the Great Lakes is said to be one of the prettiest. The others are found in Pennsylvania and the Western rivers. Hypohomus (Orange-sided Darters). One, a large species, is known. Diplesium (Green-sided Darters) is represented by two species. Percina (Log Perches). Species of this genus are called, respectively, LOG PERCH, HOG-FISH and JACK-PIKE. They are abundant in the great lakes and streams of the West. One only is known in North America, viz., P. caprodes (Raf.), Girard, and is the largest of the Darters, reaching a length of eight inches.

Family PERCIDÆ (*Perches*) are carnivorous Fishes, of rather large size, mostly peculiar to the rivers of the Northern hemisphere. According to the arrangement here adopted, the genera number about five, and the species fifteen. The body of the true Perch is covered with rather small ctenoid scales. The opercular bones are mostly serrated. The teeth are situated in bands upon the jaws, vomer and palatines. There are two dorsals, distinct, and both well developed; the anal has one or two spines. Yellow Perch (Perca flavescens (Mitch.), Cuv.), called, also, American Perch, is one of the best known and widely distributed of our fluviatile Fishes. Wall-eyed Pike (Stizostedium americanum, Val., Gill), called, also, Yellow Pike, Glass-eye, and Dory, attains the weight of fifteen pounds in the great lakes and Western rivers. Two other species are found in the same localities—the White Salmon (S. salmoneum), and Sanger, or Gray Pike (S. griseum). These are usually called Pike-perches, from a union of resemblances to the two forms. Lucioperca is the old generic term of Cuvier.

Family LABRACIDÆ (*Bass.*)—This family is mostly marine, and embraces perch-like Fishes having the general characters of the preceding family. There are fifteen genera and thirty-five species. The Striped Bass, which has a place here, has been noticed in our account of Marine Fishes. White Bass, or Striped Lake Bass (Roccus chrysops (Raf.), Gill) is found in the great lakes and the Upper Mississippi. Besides the Marone americana (marine) the Short-striped or Brassy Bass (M. interrupta, Gill) is known to the southern part of the Mississippi Valley.

Family ICHTHILIDÆ.—These are perch-like Fishes, with a single dorsal, called Sun-fishes. Many build nests. There are fifteen genera and about forty species, all American; most abundant in the Mississippi Valley. Oswego Bass (Micropterus nigricans, (Cuv.), Gill), also called Large-mouthed Black Bass, is found in the great lakes, and is particularly well known in Buffalo and Oswego; Small-mouthed Black Bass (M. fasciatus (Lac.), Gill) is described by DeKay as Centrarchus. The genus Centrarchus, embracing the Many-spined Bass, has one species in our waters—The Shining Bass (C. irideus (Bosc), Cuv. and Val.), which is found in the rivers of the Southern States. Pomoxys (High-finned Bass) has two species—P. hexacanthus and P. annularis. The latter bears the name Bachelor and New Light in Kentucky, and Crappie in St. Louis. They are regarded as good food Fishes. Ambloplites has Rock Bass, Goggle-eye, Red-eye (A. rupestris (Raf.), Gill), abundant in the great lakes and rivers west of the Alleghanies; and A. cavifrons, Cope, habitat, Roanoke River. Acantharchus is represented by the Mud Sun-fish (A. pomotis (Baird), Gill), found in muddy streams, coastwise about New Jersey and New York. Four-spined Sun-fish (Hemioplites simulans Cope) is found in James River, Va. Enneacanthus, Gill, embraces the Nine-spined Sun-fishes. The species are: Spotted Sun-fish (E. boesus (Baird), Gill), in streams, coastwise from Massachusetts southward; Black-banded Sun-fish (Mesogonistius chœtodon (Baird), Gill), New Jersey and Maryland, in sluggish waters; a small and handsome species. The Black Sun-fish (Glossoplites melanops, Jordon)—Calliurus of Agassiz—is found in the Illinois River and southwards to Texas. The Red-eyed Bream (G. gilli (Cope), Jordon) is found in Virginia and southward, east of the Alleghanies. Blue-spotted Sun-fish (Chænobryttus cyanellus (Raf.), Jordon), habitat, Ohio Valley and westward. Other species are: C. gulosus and Chain-sided Sun-fish (C. nephelus (Cope), Jordon), habitat, Ohio Valley. Blue Sun-fish (Ichthelis incisor (Cuv. and Val.), Holb.), called, also, Copper-nose Bream, found in the great lakes and the Delaware River. There are eleven other species and varieties inhabiting the rivers and lakes of the middle and western portion of North America, many of which are beautiful in colors. The only one which occurs in New England is the Northern Red-tail (I. appendix, (Mitch.), Bliss), ranging from Maine to North Carolina. Pomotis is exclusively an American genus, composed of fresh-water Fishes entirely, and is closely allied to the preceding. Cuvier says that the common people, in naming the typical species *Perch*, were more correct in their conception of the characters than naturalists had been. Common Sun-fish (Pomotis auritus (Linn.), Günther), also called Pumpkin-seed and Bream, is the most familiar form of fresh-water Fishes; known to every country boy within the range of the great lakes and streams, mostly northward and east of the Alleghanies. It is P. maculatus, aureus, vulgaris and luna of authors. Mitchill names it Morone maculatus. Linnæus recorded it as Labrus auritus. Two other species are abundant in the Tennessee River.

Family APHREDODERIDÆ (*Pirate Perches*).—In these forms the vent is jugular, in front of the ventral fins. The dorsal is single, high, with three spines only; ventrals are thoracic, without spines and with more than five soft rays. Some of the head bones are spinous. The palate and jaws are armed with teeth. Scales are ctenoid. A single species only is known—The Pirate Perch (Aphredodorus sayanus (Gilliams), DeKay). It is found in brooks along the coast of the Eastern and Southern States, from New York to Louisiana, and is remarkable for its voracity and for its nocturnal habits. The unusual situation of the vent distinguishes it widely from the *Percidæ*.

Family SCIÆNIDÆ (*Maigres*).—The members of this family are chiefly marine. The genus Haploidonotus, collectively called Bubblers, has three species. The Sheep's-head, White Perch, Grunter or Drum, are names applied to one, and the others are respectively named for the Tennessee and Missouri Rivers, where they are found. Eutychelithus, including the Lake Huron Drums, is represented by one species. The generic term is from the Greek, meaning "lucky," and "a stone," from the fact that the ear-stones, or bones, are large, and are used as "lucky stones" by the boys of the region.

FAMILY COTTIDÆ (*Sculpins*).—The marine species of this family have been treated elsewhere. There are about seventy species in twenty genera, mostly known in Northern waters. A few small species abound in the fresh-waters of Europe, Asia and North America. They are all exceedingly ugly in aspect, particularly those of the salt seas. Uranidea is represented by four species, one being the COMMON MILLER'S THUMB, known equally well both in Europe and America. Pegedichthys, collectively named Spring-fishes, is represented by three species, among them the CAVE BULL-HEAD, which abounds in the caves of the limestone regions of the Western States. Triglopsis (Lake Sculpins) has one species, found in stomachs of deep-water Fish.

FAMILY GOBIIDÆ (*Gobies*).—This includes both marine and fresh-water forms. NAKED GOBY (Gobiosoma molestum) is the only species known in our waters. Prof. Putnam obtained the first specimen in the Ohio River, near Louisville.

FAMILY GADIDÆ (*Cod*).—One genus and one species only known to our fresh-waters. LING (Lota lacustris (Mitch.), Gill), called, also, BURBOT, LAKE LAWYER, EEL-POUT and LAKE CUSK, found in the great lakes and streams of New England and northward, but is rarely used for food. It is L. inornata of DeKay, L. brosmiana of Storer, and is closely related to L. vulgaris of Europe.

FAMILY GASTEROSTEIDÆ (*Sticklebacks*).—Both marine and fluviatile. Two species are confined to interior lakes. OHIO STICKLEBACK (Eucalia inconstans (Kirtland), Jordon), called, also, BROOK STICKLEBACK, has a range from Ohio to Minnesota and Kansas. It is abundant in sluggish streams, and is particularly notable for its nest-building habit and pugnacity. The marine species are found often in rapid streams that lead into the sea. Pygosteus is represented by three species, called MANY-SPINED.

FAMILY ATHERINIDÆ (*Silversides*).—Five genera and forty-five species are enumerated, a few being permanently in fresh-water. SILVER SKIP-JACK (Labidesthes sicculus, Cope), called, also, RIVER SILVERSIDE, is abundant, but, until lately, was little known. Its form and silvery aspect render it very beautiful.

FAMILY CYPRINODONTIDÆ.—These are small Fishes of fresh or brackish waters in both continents. One hundred and twenty species and twenty-five genera are known. Though we have numerous species, they are not well characterized as to the genera. One species from Florida is said to be the smallest known vertebrate. Fundulus (Killi-fishes) has one species, found inland in clear springs. Others are marine, though sometimes found in fresh-waters near the coast. Zygonectes (Top Minnows) is represented by four species in the Mississippi Valley and vicinity.

FAMILY UMBRIDÆ (*Mud Minnows*).—These are small Fishes, like the preceding in most respects, found in muddy brooks, among weeds, often, or usually embedded in mud. Melanura, with one species, called DOG-FISH, MUD DACE and MUD MINNOW, is found from New Jersey to Minnesota.

FAMILY ESOCIDÆ embraces Fishes of exceeding voracity, some reaching a large size. With a single exception (the Pike of Europe), all belong to the United States. One or two genera and from five to twenty species are enumerated. THE GREAT PIKE (Esox nobilior, Thompson), called, also, MUSKALLUNGE, is a splendid Fish, reaching the length of six feet; common to the great lakes. E. lucius (GREAT LAKE PIKE, or NORTHERN PICKEREL) is found, also, in the great lakes and headwaters of the Mississippi; length, three or four feet. It is regarded as the best edible Fish of the Western waters. COMMON EASTERN PICKEREL (Picorellus reticulatus (Leseur) Jordon), called, also, the GREEN PIKE. This familiar Fish of our fresh-water streams and lakes is known in the Atlantic States, but not far in the interior. It is Esox lucius of Mitchill. DeKay says it does not extend above the great lakes, but is common in the Middle and Eastern States. Storer remarks that the Pickerel is taken in considerable numbers for Boston market, at Brewster, Cape Cod, where they often weigh seven pounds, and even larger ones are known. THE BANDED PICKEREL (P. americanus (Lac.), Jordon), called, also, TROUT-PICKEREL, is found in streams along the Atlantic shores. It is the VARIED PIKE (Esox fasciatus) of DeKay, and E. scomberius, niger, and ornatus of authors. P. salmoneus (WESTERN TROUT-PICKEREL) is abundant in Western streams.

FAMILY AMBLYOPSIDÆ (*Cave Fishes*).—Fishes of small size, living in the limestone caves of the Middle and Southern States. Three genera and four species are all that are yet known. Prof. Putnam thinks it most probable that more, and "perhaps new species and genera will be found in the lowlands and subterranean springs." Two groups are recognized, one with eyes rudimentary, concealed under the skin, and body colorless; another with eyes well developed, with body colored, etc. LARGER BLIND-FISH (Amblyopsis spelæus, DeKay), Plate X, fig. i. This is the Blind-fish of the Mammoth Cave, Ky., and also of the cave of Wyandotte. Prof. Putnam has given some valuable information concerning this form in *American Naturalist*. Dr. Wyman gives an account, also, in that work, vol. i, p. 143. Typhlichthys has the general characters of the preceding, with same localities; the species are rather smaller. Chologaster (Ditch Fishes) includes those having eyes, and colored skin. Two species are known, found in ditches and subterranean streams.

FAMILY PERCOPSIDÆ (*Trout Perches*).—One genus, with one species, comprises the representation of this family in our waters. The general aspect is like the Salmons, but the mouth and scales are perch-like. Percopsis guttatus is found in the great lakes, and in the Potomac and Delaware Rivers.

FAMILY SALMONIDÆ (*Trout*).—Sixteen genera and one hundred and sixty species are known in the fresh-waters, many of them periodically descending to the sea; a few are permanently marine. GREAT SEA SALMON (Salmo salar, L.)—This magnificent Fish ranges over Northern Europe and America, southward to Cape Cod. S. fontinalis, Mitchill (COMMON BROOK TROUT), is a justly-prized edible Fish, and

one of the most beautiful in form and ornamentation. Six other species are recorded, several of them found in Maine. DeKay, speaking of the Lake Trout (S. confinis), says: "The average weight is from eight to ten pounds, and I have heard fishermen speak of some weighing thirty pounds and even more." Osmerus (The Smelt) has been treated among the Marine Fishes. A variety called Land-locked Smelt (O. spectrum) is found in Wilton Pond, Me., and Abbott's Smelt (O. abbotti), in Cobessicontic Pond, Me. Thymallus (Grayling) is represented by one species—T. tricolor—a very beautiful Fish, found in Michigan. Argyrosomus (Siscoes) embraces five species—The Lake Herring, Tullibee, Black Fin, etc., inhabiting deep water of the great lakes. Lake White Fish (Corregonus albus, Leseur) also inhabits the great lakes. This is, perhaps, the most notable of edible Fish found in the fresh-waters of North America, ranking, probably, about as the Cod or Haddock does in our coast marketing. It is most abundant in Lake Huron, but is taken, also, in Lake Erie. It is found northward to the Arctic Sea.

Family HYODONTIDÆ.—A single species inhabits the Western streams and the great lakes. Hyodon (Moon-eyes) is represented by the Silver Herring or Toothed Herring (H. tergisus, Leseur), one of the most beautiful of fresh-water Fishes.

Family CLUPEIDÆ (*Herrings*).—Twelve genera and one hundred and twenty species are known, many of them marine. Besides the Shad and Alewife, there are the Cayuga Lake Shad (Pomolobus lacustris, Jordon), and Ohio Golden Shad (P. chrysochloris, Raf.) Dorosoma (Gizzard Shad). The Hickory Shad is of this genus, a common marine species, and the Ohio Gizzard Shad (D. notatum, Raf.), inhabits the Mississippi and Ohio Rivers.

Family CYPRINIDÆ (*Carp-like Fishes*).—The Minnows are here included; small Fishes of the fresh-waters of the Old and New World. The genera are about one hundred and fifty, and the species number from seven hundred to one thousand. They are said to be excessively abundant where found, both in individuals and in species, and, from their great uniformity in size, form and coloration, are exceedingly difficult of identification. The largest species seldom weighs more than three or four pounds. A curious change takes place in the male during the breeding season. The top of the head, and sometimes the whole dorsal region, is covered with tubercles, in rows—epidermal spinous outgrowths. The skin of the muzzle is then swollen and colored. In some species these tubercles are quite large, covering the sides of the head. In some genera the males are temporarily adorned with red-colored tints. Exoglossum (Stone Toters) has two species, called Day Chub, Cut Lips, etc., found in western New York. Campostoma has one species, which is everywhere abundant in the Mississippi Valley, and is said to be one of the most interesting of American Fishes. The name *Stone-roller*, which it bears in the South, refers to habits of moving stones by which to form nests. The following genera are recorded: Pimephales (Round-headed Minnows), two species; Hyborhynchus (Blunt-nosed Minnows), one species; Hybognathus (Blunt-jawed Minnows); Ericymba (Silver-mouthed Dace); Semotilus (Fall-fish), including the several species of Chub found in Massachusetts; Ceratichthys (Horned Chub); Rhinichthys (Long-nosed Dace); Phenacobius (The Phenacobies); Hybopsis (Blunt-faced Minnows); Hemitremia (The Hemitremes); Chrosomus (Red-bellied Minnows); Phoxinus (European Minnows); Lythrurus (Red Fins); Luxilus (Shiners). Common Shiner (Luxilus cornutus (Mitch.), Jordon), Red Fin, Roughhead. This is one of the more familiar forms, inhabiting streams and ponds from Maine to the Rocky Mountains. DeKay records it as Leuciscus cornutus (Red Dace), and Storer as Hypsolepis cornutus. One other species is found in the Tennessee River. Plargyrus (Silver Fins) embraces two species found in the lakes and rivers of the West. Photogenis (White-cheeked Shiners) has six species, all of the Western rivers. Minnilus (Rosy-faced Minnows) is represented in the Western streams by six species. A variety of M. rubrifrons (Cope), Jordon, called Abbott's Rosy Minnow, is known in the Delaware River. Notemigonus (Golden Shiners) is represented only by the Stilbe, Bream, or Shiner (N. americanus (Linn.), Jordon. This is among the largest of the family, bearing a strong resemblance to a young Shad, and is found in streams from New England to Minnesota and south. Carassius (Crucian Carps). This genus includes one species—the well-known Golden Carp (C. auratus (Linn.), Bleeker); originally brought from Asia, and is now everywhere naturalized. The wonderful tenacity of life and great powers of reproduction of this Fish render it immensely numerous wherever it is found. Small pond holes near the Central Park, New York, as well as the lakelets and streamlets which are in the park, are abundantly stocked. In a notice of this species elsewhere we have stated that a wonderful change is effected in both form and color. The color is not only changed, but the eyes and tail are altered permanently in their aspect. Specimens of the more notable of the species are kept alive in the New York Aquarium. The European Carp (C. carpio, L.), introduced, is found in some Eastern rivers.

Family CATOSTOMIDÆ (*Suckers*).—These are Fishes of similar character to the last, of medium or large size. Ten genera and about fifty species are known. They abound everywhere east of the Rocky Mountains. Two or three are known to China and Japan; all the rest are North American. Catostomus (Brook Suckers) has two species recorded by Jordon. DeKay says the Common Sucker is seen in the New York market in autumn, but does not speak highly of its flavor. Hypentilium (Big Stone Luggers) has one species known in "lakes and streams from New York to the south and west, and is abundant and one of the most singular of Fishes." Erimyzon (Chub Suckers). Three species comprise this genus in our waters. The Creek-fish or Chub Sucker (E. oblongus (Mitch.), Jordon) is known in New England and southward, and is also abundant in the great lakes. DeKay records it as

THE BRILLIANT CHUB SUCKER (Labeo oblongus), and says: "It is a Fish of much beauty, and one about which confusion has arisen on account of applying a European name." Moxostoma (Red Horses). Seven species of this genus are found in the great lakes, quite abundant, and in streams in Virginia and North Carolina. Several are called MULLET and CARP MULLET. Placopharynx is represented by one species, called COPE'S SUCKER (P. carniatus, Cope). It was only lately discovered in the Wabash River. Carpioides (Carp Suckers). In this genus are six species, called SPEAR-FISH, SAIL-FISH, QUILL-BACK, SKIM-BACK, and BUFFALO CARP and SILVERY CARP SUCKER. Ichthyobus (Buffalo Fishes) has one known species, inhabiting the valley of the Mississippi. Bubalichthys (Buffalo Suckers). One species only has been described, though others are known; habitat, in the Mississippi Valley. Cycleptus (Suckerels), called, also, BLACK HORSE, GOURD-SEED SUCKER, LONG BUFFALO and MISSOURI SUCKER. These local names are applied to this singular species, which is quite different from any other. It is found in the large streams of the Mississippi Valley.

FAMILY SILURIDÆ (*Cat-fishes*).—These are chiefly fresh-water Fishes, seemingly related to the Sturgeons. There are no true scales; the skin is naked, or has bony plates. There is usually an adipose fin, and the dorsal and pectorals are armed with a spine. The ventrals are abdominal. There are one hundred genera, or more, and nearly seven hundred species, all abounding in American waters. The species, though numerous, are yet closely related. Ictaturus (Channel Cats) has five species enumerated under this head. Amiurus (Horned Pouts) is the Pimelodus of early authors, and includes, among twelve species, the POTOMAC CAT (A. lynx (Girard), Gill), inhabiting the rivers from New Jersey to South Carolina; BIG-MOUTHED CAT (A. Lophius, Cope), found in the Potomac; BLACK BULL-HEAD (A. pullus, (DeKay), Gill), found in the lakes of New York and eastward, abundant. HORNED POUT (A. atrarius (DeKay), Gill), ranges from New England to Maryland and the great lakes. THE GREAT LAKE CAT-FISH (Ictalurus nigricans (Leseur), Jordon), is found to be an Amiurus. DeKay remarks: "I have seen this Fish weighing twenty-five to thirty pounds, and have heard of others which reached the weight of eighty pounds." It is not esteemed as food. Hopladelus (Mud Cats) has one species recorded. "Other species probably exist, but they have not been studied."—*Jordon.* Noturus (Stone Cats) consists of four species, ranging from the Ohio Valley to the Western lakes. One is found in the lakes of New York. Gronias (Blind Cats) has only one species known—the BLIND CAT-FISH (G. nigrilabris, Cope). It has the form of Amiurus, and is found in subterranean streams tributary to the Conestoga River, Pennsylvania.

FAMILY ANGUILLIDÆ (*Eels*).—The Eels have been considered in our account of Marine Fishes. Jordon says: "There are two or three genera and about forty species. Found in seas and sluggish fresh-waters of all regions."

SUB-CLASS—GANOIDEI.

FAMILY AMIIDÆ (*Bow Fins*).—A single species of this family is known to the United States. "In some regions it is called 'Lawyer,' because it is said it will bite at anything, and is good for nothing when caught."—*Jordon.* DeKay records it as THE WESTERN MUD-FISH (Amia occidentalis). This species is found in Lakes Erie and Ontario, and is distinguished by its ferocious looks and voracious habits. It is identical with A. calva.

FAMILY LEPIDOSTEIDÆ (*Gar Pikes*).—These interesting forms are included in two or three genera, and, according to Jordon, about five species are all that are strictly identified. Lepidosteus (Long-nosed Gars) includes the single species GAR PIKE (L. osseus (Linn.), Agassiz)—Plate X., fig. iv.—abundant in large bodies of fresh-water, from New York to the south and west. Cylindrosteus (Short-nosed Gars) has one species recorded (C. platystomus) as found in the great lakes and streams of New York and westward. Litholepis (Alligator Gars) has one known species—the GREAT GAR (L. adamanteus, Raf.); inhabits the waters of the Mississippi Valley northward to Illinois, and is abundant southward. This is a large species, reaching the length of eight feet, with head and mouth resembling those of the Alligator.

FAMILY POLYODONTIDÆ.—This family is the only one of the order *Selachostomi* (Spoon-bills). The peculiar character is a snout produced into a long and spatula-like process. There are two species, one found in China, and the other in the Mississippi Valley. Polyodon (Duck-billed Cat) has a species named P. folium, which, in some regions, is called SPOON-BILLED STURGEON, and is said to bear considerable resemblance to a Shark.

FAMILY ACIPENSERIDÆ (*Sturgeons*).—Of this family there are only two genera and about twenty species, according to Günther, though some authors make more. Dumeril, for example, enumerates eighty. Acipenser (Sturgeons) has four species recorded by Jordon as inhabiting our waters. Scaphirhynchus (Shovel-nosed Sturgeon) is a distinct form, not identical with another of the same name. It attains a large size, and inhabits the streams and lakes of the Mississippi Valley.

CLASS—MARSIPOBRANCHII—(*Lampreys*).

These forms have been considered in our account of the Marine Fishes. The following are, however, species peculiar to the fresh-water. Petromyzon (Lampreys) has several forms described, but the identity of species has not been strictly determined. LARGE BLACK LAMPREY (P. nigricans), though marine, is also found in Cayuga Lake, N. Y. P. niger inhabits the great lakes. Ichthyomyzon (Lamperus) is a genus comprising three known species, inhabiting the great lakes and Western rivers. THE SILVERY LAMPREY (I. argentatus (Kirt.), Girard) is found as far east as New York. The others are known in the streams of the South-west.

HISTORY

OF

THE AMERICAN FAUNA.

INVERTEBRATA.

Cuvier and Lamarck introduced the terms *Vertebrate* and *Invertebrate* to designate the two great primary divisions of the Animal Kingdom; those having no semblance of a backbone being embraced in the latter division. Aristotle recognized this distinction when he regarded "all sanguineous animals" as having "either a bony or spinous column." The *Radiata*, *Articulata* and *Mollusca* were for a time acknowledged as the accepted division of the *Invertebrates*. *Radiates*, however, exhibit forms which, in their structural characters, cannot naturally be associated together, and a fifth sub-kingdom was, therefore, established, called *Protozoa*. The arrangement of the Invertebrate animals, according to Prof. Huxley, is as follows:

I.—Mollusca.	IV.—Annulosa.
II.—Molluscoidea.	V.—Annuloidea.
III.—Cœlenterata.	VI.—Infusoria.

VII.—Protozoa.

Aristotle had named certain of these low forms, as Acalephæ and Knidæ; but Seba, and Klein, and Rondelet, contemporaneous authors of the sixteenth century, advanced the study to something like a system, yet without any attempt at classification. Rondelet had studied and figured the marine animals of the Mediterranean. These, however, are all grouped as Fishes, and, in some instances, his illustrations and descriptions are those fanciful forms of an earlier age. Cuvier was the first to present a scientific examination of the structure and classification of these animals, particularly the *Radiates*. In the early part of the present century, the French nation associated scientific objects with the government expeditions. Napoleon's Egyptian campaign resulted in the production of some of the finest work of French naturalists, particularly the beautiful figures of *Radiates* given by Savigny, and obtained while attached to this expedition.

In the years preceding the latter half of this century, the knowledge of Invertebrate forms in American waters was extremely limited. The few *Actiniæ* and Campanularias then known were looked on with wonder, and called "animal flowers." In the vicinity of Boston, especially on the rocks and beaches of Nahant, a few specimens were to be seen, chiefly the one species, Actinia marginata, and sparsely, slender clusters of the pretty Hydroid tubularia; while the myriads of less conspicuous forms were not then recognized. The Massachusetts State Survey offered the first opportunity to give scientific attention to this subject; the result of which was the publication, in 1841, of *Invertebrata of Massachusetts*, a report made by Dr. A. A. Gould, who had charge of that department of the survey. The Shell-fish are here very fully treated, while the etchings on copper are among the best that have been published. The labors of certain members of the Essex County Natural History Society, and those of the Boston Society, added much information on the subject; while the Lyceum at New York and the Philadelphia Academy of Sciences were doing the same good work. Among the members of the Essex Society we recall with pleasure the names of Dr. Wheatland, Messrs. True, Putnam and others, and at Lynn, Messrs. Tufts and Haskell—all zealous workers in the various branches of Marine Zoölogy. In later days, Agassiz (father and son), Leidy, Stimpson, Clark, Verrill and Gill have advanced the knowledge of our *Invertebrates* very materially. Prof. Verrill, of Yale College, at the head of the laboratory of the United States Fishery Commission, has had favorable opportunities for investigation of the Marine Fauna, from the explorations of that body, during the summer months, between Halifax, N. S., and Connecticut. This Commission, under the able management of Prof. Baird, by establishing its headquarters annually at a different camping-place between these points, and by means of a small steamer, well-fitted with the most approved apparatus, has discovered many new forms, found some which have heretofore been rare, and procured live specimens of others for the first time. These aids to the study of this branch of science have been fully appreciated. No better facilities were formerly found for such work, other than those afforded by the fisherman's good-will and his kindly offerings out of his "day's fare"—such as a chance at his pile of offal, whereof the stomach and intestines were a mine of wealth. "Full many a gem" has thus been recovered from the

"Maw, and gulf
Of the ravin'd salt-sea Shark."

SUB-KINGDOM—MOLLUSCA.

THE term *Mollusca* is used to designate the second of the five grand divisions or structural types of the Animal Kingdom. The science which treats of Shell-fish—shells and their living inhabitants—is called Conchology. The soft parts were almost unknown to the ancients; consequently the shells, or exterior coverings, were studied and classified independently of the living animal. Mollusks, or Shell-fish, as they are collectively called, are divided into several great branches. The best approved arrangement is that adopted by Dr. Theodore Gill, in his *Families of Mollusks*, which accords with the system and collections of the Smithsonian Institution. It is as follows:

CLASS A.—CEPHALOPODA.

Order I.—DIBRANCHIATA.
Sub-order—OCTOPODA.
Four Families.
Sub-order—SEPIOPHORA

Order II.—TETRABRANCHIATA.

CLASS B.—GASTEROPODA.

SUB-CLASS—DIŒCA.

Order III.—PECTINIBRANCHIATA.
Sub-order—TOXOGLOSSA.
Sub-order—RACHIGLOSSA.
Sub-order—TŒNIOGLOSSA.
Sub-order—PTENOGLOSSA.

Order IV.—HETEROPODA.

Order V.—RHIPIDOGLOSSA.
Sub-order—PODOPTHALMA.
Sub-order—DICRANOBRANCHIA.

Order VI.—DOCOGLOSSA.
Sub-order—PROTEOBRANCHIA.
Sub-order—ABRANCHIA.

Order VII.—POLYPLACOPHORA.

SUB-CLASS—PULMONIFERA.

Order VIII.—PULMONATA.
Sub-order—GEOPHILA.
Sub-order—BASSOMATOPHORA.

SUB-CLASS—OPISTHOBRANCHIATA.

Order IX.—TECTIBRANCHIATA.

Order X.—NUDIBRANCHIATA.
Sub-order—PYGOBRANCHIA.
Sub-order—POLYBRANCHIA.
Sub-order—PELLIBRANCHIATA.

SUB-CLASS—PTEROPODA.

Order XI.—THECOSOMATA.

Order XII.—GYMNOSOMATA.

SUB-CLASS—PROSOPOCEPHALA

Order XIII.—SOLENOCONCHÆ.

CLASS C.—CONCHIFERA.

Order XIV.—DIMYARIA.

Order XV.—METARRHIPTÆ.

Order XVI.—HETEROMYARIA.

Order XVII.—MONOMYARIA.

Order XVIII.—RUDISTA.

SUB-BRANCH.—MOLLUSCOIDEA.

CLASS D.—TUNICATA.

Order XIX.—LACCOBRANCHIA.

Order XX.—DACTYLOBRANCHIA.

Order XXI.—TÆNIOBRANCHIA.

Order XXII.—LARVALIA.

CLASS E.—BRACHIOPODA.

Order XXIII.—ARTHROPOMATA.

Order XXIV.—LYOPOMATA.

CLASS F.—POLYZOA.

Order XXV.—PHYLACTOLÆMATA.

Order XXVI.—GYMNOLÆMATA.

Order XXVII (?).—RHABDOPLEURÆ.

Most Mollusks are enclosed in an external shell; the acephalous forms are always thus provided, the shell being in two pieces; hence the term, *Bivalve*. The Gasteropods have one covering of shell, and are designated *Univalves*. A few of the latter have no shells whatever. Others have a more or less perfect internal shell, secreted beneath the mantle, as in the naked snails and slugs. In the egg of a Mollusk the nucleus of the shell is seen to cover the young animal even before the internal organs begin to assume definite form, and is noticeable from its transparent horn color. After the birth of the Mollusk, the growth of the shell is promoted by additions of carbonate of lime and animal matter to the lip or circumference of the aperture. This is effected by secretion from the edges of the mantle which lie in contact, the soft deposit becoming calcified on exposure to the air. The external skin or epidermis which covers the shell, as well as its cellular substance, is exuded from the collar or neck of the animal, the more delicate porcelain-like interior and "Mother of Pearl" being secreted from the interior or visceral membranes. Analysis has revealed the presence of sulphuric and muriatic acids in the saliva of some Mollusks. This fact sheds a degree of light upon the hitherto vexed questions regarding the boring habits and destructive powers of these animals. The operculum, seen in univalves, is a horny plate, sometimes quite thickened by a deposit of lime or shell, and adapted to cover the opening when the animal is entirely within. It is a means of defense, and in some of the large Conchs it is a falchion-like weapon, capable of considerable mischief. The shell of Mollusks may be considered their external skeleton. We find certain muscles attached, mainly those to serve the purpose of closing the valves; yet others, in the bivalves, are seen to control the movement of the mantle. In the higher Cephalopods the muscles quite resemble those of the *Vertebrates*, being attached to cartilages, representing the attachment to bones. Cephalopods are furnished with horny jaws, with which they secure their food. The Helices have an upper jaw only, which is opposed to a

tongue covered with silicious teeth. In the Snail (Limnea) there are two accessory jaws on the sides. Bivalves have a mouth with a pair of soft membraneous palpi. Many of the higher Mollusks have a tongue, or *lingual ribbon*, which is studded with small teeth that are sufficiently hard to break the food. The bivalves have no tongue. A peculiar styliform cartilaginous body is found in the stomach of some species, which is thought to be the representative of a gizzard; this has been called the *gastric dart*, and was formerly mistaken for a tongue. The liver of Mollusks is always large. The renal organ is well demonstrated in nearly all species.

Like the vertebrate intestine, those of the Mollusks are longer and convolute in the herbivorous species, and short in the carnivorous. In bivalves the intestine is very much convoluted, passing through the ventricle of the heart, and terminating near the respiratory aperture, whence the excrements are washed away by the water from the gills. The heart includes an auricle, occasionally double, which receives the blood from the gills and a ventricle for its propulsion into the arteries. The blood is colorless, or pale gray. Respiration is performed under water by the Cephalopods, the Acephala and the Brachiopods; they breathe as the Fishes do, respiring water from which the oxygen is absorbed by the gills. The Gasteropods are partly air-breathing and partly water-breathing; the Land Snails are a familiar example of the former. The nervous system is represented by a ring of ganglia surrounding the throat in the Cephalopods and Gasteropods, and in the Acephala it is situated on the posterior adduct or muscle. Touch is the most important sense to these creatures, and this resides in every external portion. Specialized organs exist—the tenticles, for example, which are situated on the top of the head—and many species have numerous tentacular appendages that are sensitive to touch; these exist in all classes. The encephalous species seem to be endowed with a sense of taste, as their food is selected usually with some care. Smell is supposed to be a sense of the univalves, but not of the bivalves. Sight is an attribute of the higher forms. Many of the Cephalopods have well-developed and very beautiful eyes, some being sessile, much resembling those of the *Vertebrates*, and others are on foot-stalks. Some of the bivalves have numerous eyes, situated among the tentacular filaments of the mantle. Hearing is accorded to the higher Cephalopods, some having external ears and auditory capsules, connected with auditory nerves; these capsules contain one or more *otolites*, or earbones. Voice is absent, with a very few exceptions. The Cephalopods squeak, and emit a sort of groan, when removed from the water; and some *Nudibranchiates* are credited with the same function. Reproduction is effected in the higher forms by the agency of two individuals. The Cephalopods and nearly all of the Marine Gasteropods are of this group. Others are *monœcious*, the sexes being united in one individual. The eggs of Marine Mollusks are deposited in clusters or in masses upon the rocky bottoms, or often upon floating débris. Many of them are curiously formed in a series of chain-like links. A species of South American Snail lays eggs of the size of those of a Pigeon, which are esteemed as food by the natives. The economical value of Shell-fish is of no little importance. Though small and seemingly insignificant as many are, the enormous numbers of individuals have rendered them an item, collectively, that geology shows to be of great significance.

Recent statements place the number of families of *Mollusca* at three hundred, including between twenty-five and thirty thousand living species. About an equal number of fossil forms are also known. In the language of an author, "They have become the testimony of the rocks," and "The medals of creation." Whole mountain ranges are formed of their disintegrated remains. Immense marine deposits are wholly the débris of calcareous and silicious shells, the cast-off skeletons of as many living animals. As food these creatures are equally important, both to man and the inferior beasts. From the times of the prehistoric "cave-men" to the present, the delicious bivalve, in variety, has held high rank as an edible. The consumption of Oysters alone is simply enormous. Among the various manufactures of shell, buttons form a large proportion. Cameo-cutting calls for great numbers of the marine Conchs. Pearls, both precious and the "Mother-of-Pearl," afford employment for great numbers in all parts of the world. The byssus, or silky floss, seen attached to Mussels, and by which the shell fastens itself to other objects, is utilized by the Italians, who spin it into delicate hosiery, which resembles the finest silk. From the remotest time Whelks have been notable as bearers of the *Tyrian Dye*. Several well-known species of shells upon our own coast emit a similar brilliant purple fluid. The growth of shells is often very rapid. The Land Snails are mostly biennial; they are hatched in the summer and autumn, and by winter time they are half grown, and in a year's time they have attained full size. Garden Snails have lived in confinement eight years. Many of the bivalves, as the Mussel, according to Woodward, attain their full growth in one year. The Oyster continues four or five years and then ceases to grow outwards; after this the shell continues to thicken. Some Mollusks are notable for tenacity of life. Mr. Gray, of the British Museum, received a living Pond Mussel from Australia, which had remained out of water more than a year. Pond Snails are often found in mahogany which is brought from Honduras. One naturalist in Calcutta found shells living in his cabinet that had been there five years.

The permanency of *Mollusca* is well provided for by their fecundity. The spawn of a single doris is estimated by Darwin to contain six hundred thousand eggs; a River Mussel produces three hundred thousand young in a season. The aquatic species have many enemies, or they have a numerous following that look to them for subsistence. The terrestrial Shell-fish are less exposed and wisely planned. They lay fewer eggs; considerable instinctive care is evidently taken of them. The great bird-like eggs of the tropical Bulimi are placed carefully within leaves

and cemented over to protect them from enemies. The oceanic Snail, or Janthina, carries hers in a floating raft alongside her beautiful vessel, securely attached. The Argonaut holds hers within the protecting folds of her mantle. The River Mussel and Cyclas are said to carry their young within the mantle until the period arrives for them to shift alone.

The Molluscan Fauna of the United States is estimated as follows: Land Shells, three hundred species; Fluviatile Gasteropods, six hundred species; Fresh-water Mussels, seven hundred species; Marine Mollusks of the Atlantic, six hundred species; and about the same number of the latter on the Pacific side—in all, nearly three thousand species.

CLASS—CEPHALOPODS.

THE Molluscous animals, although having no skeleton—properly speaking, no backbone—yet outrank all others of the Invertebrate series by the perfection of their circulating system, and the assimilating and reproductive organs. On this account they are fairly placed next succeeding the *Vertebrates*. The Cephalopods are plainly the highest in organization, and naturally are arranged in front of the great class. Certain features, common to the higher animals, are noticeable in the more perfect examples of the group. The head is large, and separated from the body by a neck; the eyes are very large and complex; the ears are developed considerably; and the mouth is armed, as in some Fishes, with stout beaks. The Nautilus and Argonaut alone, of the living tribes, have external shells; the rest are termed naked Cephalopods because the shell is internal. The typical Cephalopods were well described by Aristotle, but it remained for Prof. Owen to determine certain facts regarding their internal organization. The ink or sepia, contained in a bag, is discharged for defensive purposes and is so indestructible that it is often found in a fossil state connected with the shells. The skin of Cephalopods is remarkable for its changeable nature; the cells which compose it are alternately closed and opened, by which the coloring matter is condensed or dispersed, and a constant change ensues. Belon presents figures of several forms of this class under the names *Octopus*, *Lolligo*, *Sepia* and *Calamero*, all which have been retained in the modern nomenclature. Rondelet, also, has excellent figures of several. It has been clearly demonstrated by Steenstrup, Harting and others, that several distinct species of gigantic ten-armed Squids inhabit the Atlantic waters; but until lately their existence had not been credited by naturalists. The occurrence in recent years of several of these enormous creatures on our own shores was, therefore, a surprise to some extent; and it is now ascertained that they have been frequently seen and occasionally secured by fishermen on the coast of Newfoundland, who regard the flesh as valuable for dog's meat. Prof. Verrill, in *Am. Jour. Sci. and Arts, vol. vii, p.* 158, cites twelve American examples, portions of five of which he had been able to study. The most complete specimen which has come under scientific observation, was captured in November, 1873, in Logie Bay, Newfoundland, entangled in Herring-nets. About the same time another monster Cephalopod, in Conception Bay, attacked two men in their boat. In the encounter, the creature lost two of its arms by amputation with a hatchet; a portion of one of these measured nineteen feet in length, the total length of the arm being estimated at about thirty-five feet. Although this specimen was estimated to be one third larger than the one in Logie Bay, yet the large suckers or discs were scarcely one twelfth larger than those of the latter. This feature is regarded as a good sexual distinction among Squids, the relative smallness of the discs indicating the female. The body of this individual was estimated to be ten feet long, and two and a half feet in diameter; the arms thirty-two feet long, and, allowing two feet for the head, the total length forty-four feet. In the same year another specimen, similar in dimensions to the last, was seen drifting, tail first, in a heavy sea at Coombs' Cove, Newfoundland. Seizing hold of a rock it moored itself safely, and was then pulled ashore by some men. Verrill notes a specimen which he designates Number Six, as having been cast ashore at Fortune Bay. This measured forty-two feet in length; body and head together, twelve to thirteen feet; and the two long arms thirty feet each. Another, captured in the Straits of Belle Isle, was fifty-two feet long; the longest of the long arms thirty-seven feet; and the body fifteen feet. All of these are referred to the species Architeuthis monachus. Animals of this class never float upon the surface when alive or uninjured; consequently, most of the specimens which have been taken were wounded, or already dead, and were helplessly drifting shoreward.

THE GREATER DEVIL-FISH (*Architeuthis princeps, Verrill*).—This prince of *Mollusca*, immortalized by the entertaining description of Victor Hugo in *The Toilers of the Sea*, is also called GIANT SQUID and GIANT CUTTLE. Prof. Verrill considers this species as having a more elongated form of body than A. monachus. A specimen of Architeuthis, captured on the coast of Newfoundland in 1877, was preserved in alcohol, and exhibited in the New York Aquarium, where careful measurements proved it to be about the same size as the others already noted, the body being ten feet, and the long tentacular arms thirty feet. On 2d November, 1878, at Thimble Tickle, Newfoundland, not far from the shore, one of these Giant Squids was seen by some fishermen. Its large glassy eyes peered at them, and its great syphon pumped the water vigorously, while at intervals the ink was thrown out in great quantities. The monster was aground, and was soon secured by a grapnel; the tide receded, left the creature exposed, and death

ensued, as it requires to breathe under the water, like Fishes, by means of gills. One of the arms was stated to measure thirty-five feet and the body twenty feet, and is the largest recorded at the date of its capture.

Architeuthis megaptera, Verrill.—This is much smaller than any previously-known species, the length of body and head being only nineteen inches, and the total length forty-three inches. The color is reddish-brown, speckled with darker brown, much as in the common small Squids. This unique specimen was cast ashore near Cape Sable, N. B.

Rossia hyatti, Verrill, is pinkish in color, thickly spotted with purplish-brown above, paler and more sparsely spotted beneath and on outside of the long arms; inner side of arms and front edge of mantle, pale. Rossia sublævis is larger and relatively stouter than the preceding. Both species were taken in Massachusetts Bay, and are new to science.

ORDER—DIBRANCHIATA.

The animal in this division is naked, and is formed to swim. The head is distinct; the eyes are sessile and prominent; some have eight and some have ten arms. The body is usually provided with fins; an ink gland is always present. Its habit is nocturnal or crepuscular.

OCTOPODA.

The name of this group is derived from its arms being eight in number. The males of the Octopods are comparatively scarce; and in many species, only the females are known. A singular and recently-discovered fact is that the real males of the Argonaut and several other allied forms are single arms of the Octopod, called *hectocotyle,* which were previously mistaken for parasitic worms. These arms are found to be charged with spermatozoa. Cuvier describes the hectocotyle of Octopus granulatus as "five inches in length, and resembles a detached arm of the Octopus, its under surface being bordered with forty or fifty pairs of alternate suckers." Dr. Kolliker, of Messina, describes another, the hectocotyle of Tremoctopus, which was "adhering to the interior of the gill-chamber and funnel of the Poulpe. The body is worm-like, with two rows of suckers on the ventral surface, and an oval appendage on the posterior end. The anterior part of the back is fringed with a double series of branchial filaments (two hundred and fifty on each side). The suckers, forty on each side, closely resemble those of the Tremoctopus, in miniature. Between the suckers are four or five series of pores, the openings of minute canals, passing into the abdominal cavity. The mouth is at the anterior extremity, and is minute and simple. The alimentary canal runs straight through the body, nearly filling it. The heart is in the middle of the back, between the branchiæ. It consists of an auricle and a ventricle, and gives origin to two large vessels. There is also an artery and vein on each side, giving branches to the branchial filaments. Nerves extend along the intestine, with one ganglion. The oval sac, alluded to above, incloses a small, but very long convoluted tube, ending in a muscular *vas deferens,* containing innumerable spermatozoa." The hectocotyle of the Argonaut was considered a parasitic worm, described under the name *Tricocephalus.* It is similar to the others. Though the little Spirula is the only species found on our coast that has a shell resembling those larger Cephalopods, yet it will prove interesting, no doubt, to the reader to know that through the observations of Madame Power, who made extensive studies of this class, the anatomy and the functions of the various organs are pretty well understood. Fanciful notions have long been entertained concerning the Nautilus and Argonaut. Aristotle described the latter as a little ship floating on the surface of the sea, and, in fine weather, holding up its sail-shaped arms to the breeze—a pretty fable enough, but untrue. The "sail-like" arms are used to closely envelop the delicate paper-like shell as a protection, and the shell is secreted from the edges of these "dorsal arms," as they are called. The animal is not connected with the shell by muscles, but holds upon it by clasping as above described. The *Argonautidæ* are regarded as ranking first. The next in order is

FAMILY OCTOPODIDÆ.—In this group the arms are similar, and united at the base by a web. The shell is represented by two short styles, enveloped within the substance of the mantle. Several genera are recognized, Octopus, from *Octo,* eight, indicating the number of feet or tentacular arms, as they are called. The body in this genus is generally warty or cirrhose. There are no fins. The arms are long and unequal; the suckers in two rows. The Octopods are the *Polypi* of Homer and Aristotle, and in later times were called *Poulpe.* They are solitary in habit, frequenting rocky shores, but are very active and voracious. In this country they are little known, though quite large species are found in the waters around Florida, and in the Gulf of Mexico. In Naples and other Mediterranean ports they are exposed for sale as food. Prof. Forbes observes that the Octopus, when at rest, coils its dorsal arms over its back. This would seem to indicate a foreshadowing of the development of the shell in higher species, as the Argonaut, which in the latter is secreted from the dorsal arm. Woodward records forty-six species, and it is probable that more have been discovered since.

BAIRD'S OCTOPUS (*Octopus bairdi, Verrill*).—This is the first Cephalopod of this order that has been recognized as inhabiting the waters on our coast. During the operations of the U. S. Fishery Commission in the Bay of Fundy, in the summer of 1872, several specimens of an Octopus were dredged, which proved to be new to science. Professor Verrill described the species in the *American Naturalist, vol. vii,* 1873, from which we extract the following: "It seems to be not uncommon below seventy-five fathoms, judging from the fact that we met with it in five different localities. All the specimens obtained were males, and it is probable that the females are much larger than the males, as in other species

of the genus. Most of the specimens were kept alive a few days in order to observe their habits." Like other species noticed, it is nocturnal in its habits. "The length of the largest specimen, in alcohol, exclusive of its arms, is one and three quarters inches; breadth of body one and one quarter. When living, the color was usually pale, translucent, bluish-white, thickly speckled with light orange-brown and dark brown." Specimens were taken off Head Harbor, Campo Bello, in seventy-five and eighty fathoms, and off Grand Menan. Prof. Verrill concludes: "I first dredged this interesting species while on the 'Mosswood,' in company with Prof. Baird, in honor of whom I have named it. * * * There is no other species known on the American coast north of Cape Hatteras. The southern species is very much larger, and very different in many respects."

Octopus granulatus, Lamarck.—During the dredging carried on by the U. S. Fishery Commission in Vineyard Sound, in the summer of 1877, a specimen of Octopus was taken, which is supposed to be identical with this species.

DECAPODA.

The name of this group, which means ten-footed, is derived from its having eight real arms and two tentacular ones, called tentacles; the latter being elongated and usually smooth and round, excepting near the ends, where they are expanded and armed with pedunculated suckers, or discs, each with a horny ring, the exterior surfaces of which are minutely serrated. The body is oblong, and provided with a pair of fins. In Sepia, and several other genera, the tentacles are completely retractile into pouches situated beneath the eyes; in the familiar genus Loligo they are partially retractile in the same manner. These long arms serve to seize their prey, and convey it to the mouth, and, in the genus Chiroteuthis, measure six times the length of the short ones. A portion of the sucker-armed extremity of the tentacles is adapted for the close contact and adhesion of the two for a short distance, thus forming an exact counterpart of a forceps, and serving precisely the purposes of that implement. A Fish seized with such a power is surely conveyed through the flexibility and contractile power of the tentacles to the voracious jaws of the animal. These jaws are almost an exact copy of the beaks of a Parrot. The shell of the living Decapods is either a horny pen (*gladius*) or calcareous bone. The former is a colorless, transparent, mica-like object, in some species curiously like a quill pen; even the point and truncated nib of the form is simulated.

FAMILY LOLIGOPSIDÆ.—Loligopsis pavo comprises the whole of this family in our North Atlantic waters. This creature inhabits the high seas, and is a powerful swimmer. Stimpson found it along the New England coast.

FAMILY ONYCHOTEUTHIDÆ.—The animals comprising this family are called Squids or Calamaries, and frequent the open seas of all climates. The genus Onmastrephes and two species, sagittatus and bartrami, are all that belong to the family on the North Atlantic shores. The former species is especially abundant on the shores of Cape Cod. Prof. Verrill informed us that he has seen the Squid dart upon Fishes, and nip out a piece of the neck or back of the head, and this he regarded as their usual method of capturing prey.

FAMILY LOLIGINIDÆ consists of the genus Loligo, with the two species, punctata and peali. "The former," says Dr. DeKay, "is the only one I have noticed on the coast of New York; the latter is found on the coast of South Carolina."

FAMILY SPIRULIDÆ is especially circumscribed, but one living genus being found. Spirula fragilis is the only example known. The shell is found occasionally thrown ashore on our beaches; and is very abundant on the Gulf coast, associated with Janthina. We have seen the beaches lined with them at high-water mark. The living animal has very seldom been seen. This little shell approaches near in structure to the beautiful Nautilus, and the ancient and extinct Orthoceras and Ammonite.

CLASS—PTEROPODA.

IN this class the head is more or less distinct; there are no eyes; the mouth is often furnished with cup-shaped appendages. On the sides of the mouth there are two appendages or fins, and two or four in others, on the sides of the body, between the head and abdomen, often furnished with a small intermediate lobe between them, apparently the rudiment of a foot of Gasteropods. The body is ovate or roundish, often enclosed in a thin, conical, cylindrical, or sub-globular shell, with a transverse, contracted mouth. The individual is of one sex, probably. The animal is free, floating on the surface of the ocean, aided by the use of its fins. Most are nocturnal or crepuscular in habit. Four families are enumerated as belonging to this class, embraced in two orders. Little is known of these forms, as they are mostly found on the broad ocean. Some species are the principal food of the Right Whales.

ORDER—THECOSOMATA.

In this order the gills are internal, and the body of the animal enclosed in a shell.

FAMILY CAVOLINIDÆ.—The shells are symmetrical, elongate, or globular, and calcareous in structure. The gills are in pairs. The animal has two united fins, without any posterior foot-like appendage between them. One genus, Diacria, and one species comprise them.

FAMILY CYMBULIIDÆ.—This family embraces but one genus, Psyche, and one species, P. globosa. The body is round and diaphanous, with a beautiful purple visceral sac.

FAMILY LIMACINIDÆ.—One genus and two species comprise this family. The shell is spiral, transparent, with a distinct spiral and vitreous operculum. Heterofusens balea was found along the coast, from Cape Cod northwards, by Stimpson, who named it Spirialis gouldi. It is minute, only one-tenth of an inch in length, and resembles an ordinary shell of Gasteropod. H. retroversus is a species found abundantly at Nahant by Mr. Alex. Agassiz. An interesting account is given of its habits in Gould's *Invertebrata of Massachusetts.*

ORDER—GYMNOSOMATA.

The body in this order is naked, having no shell. The head is distinct. There are two or four wings at the junction between the head and the body, with a central intermediate lobe or rudimentary foot. The gills are exterior.

FAMILY CLIONIDÆ.—The animal is fusiform; the head with a series of conical prominences on each side. There are two wings, with a central, foot-like appendage between them. There are two genera.

CLASS—GASTEROPODA.

THIS great division in the *Mollusca* is characterized by individuals having a distinct head, which is furnished with eyes and tentacular appendages or feelers. The body is usually protected by a spiral or conical shell. The lower part of the body is formed into a thickened, expanded creeping disc or foot. The Gasteropods, including the Land Snails, Sea Snails, Whelks, etc., are regarded as particularly typical of the *Mollusca*, presenting all the leading features of the class organization in a prominent degree. They are less like the Fishes than the Cephalopods, and less in resemblance to the Articulates and Zoöphytes than the Bivalves. The ordinary and characteristic mode of locomotion is exemplified by the common garden Snail, which creeps by successive expansion and contraction of its broad foot. Gasteropods are nearly all unsymmetrical. The body is coiled spirally, and the respiratory organs of the left side are usually undeveloped, more or less. In the Chiton and Dentalium the branchiæ and reproductive organs are repeated on each side. A few species are viviparous, including the Helices; the rest are egg-bearing. Gasteropods have what is termed an *odontophore*—a "tooth-bearer," or lingual ribbon, situated within the month, which is beset with fine chitinous teeth. The odontophore is a curiously-developed organ, which has been described by Huxley as consisting "essentially of a cartilaginous cushion, supporting, as on a pulley, an elastic strap, which bears a long series of transversely-disposed teeth The ends of the strap are connected with muscles, attached to the upper and lower surface of the hinder extremities of the cartilaginous cushions. These muscles, by their alternate contractions, cause the toothed strap to work backward and forward over the end of the pulley formed by its anterior end. The strap consequently acts after the fashion of a chain-saw upon any substance upon which it is applied." This lingual ribbon, as well as the hard, horny substance which closes the aperture to the Gasteropods, is important in the matter of classification, both being much used at present as guides. The teeth of the former are particularly regarded. The Gasteropods form two natural groups, one comprising the air-breathing forms, and the other those breathing through the medium of water, like the Fishes. Those of the first group are apparently perfect when born, differing only in size from the parent. The water breathers have a small nautilus-like shell at first, which conceals them entirely at will, and which is closed by an operculum. They do not creep, but swim with ciliated fins, which are formed upon the sides of their head. By this means Nature has provided that though they are quite circumscribed when fully grown, they may be widely dispersed when young. This form of young Mollusk may be fairly compared to the larva of insects. The young of the fresh-water Gasteropods are perfect, though they may not be seen by the naked eye. Dr. Gill says: "The principal modifications of structure are exhibited in the following groups, to which have been assigned the rank of sub-classes: 1. *The Diocea;* 2. *The Pulmonifera;* 3. *The Opisthobranchiata;* 4. *The Polyplacophora;* 5. *The Prosopocephala;* 6. *The Pteropoda.*" Under the class *Gasteropoda*, Binney gives the following arrangement of shells found on the coast of New England:

FAMILY BULLIDÆ embraces seven genera and fifteen species. Many of them are delicate, bubble-like shells, as the family name imports (see Plate 4, figs. 1, 2, 3, and 4). Several species are found in the stomachs of Cod and other Fishes taken in the deep water on Grand and George's Banks. We have frequently taken them in this manner from Fishes caught off Nahant.

In the order *Nudibranchiata* there are six families of very interesting forms. The creatures which are included here are naked, having no shells, but many are beautifully decorated with branching breathing organs and tentacular-like appendages (see Plates 4, 5, 6). Many species are found clinging to masts and spars around the dock-yards. Several forms have been dredged by Dr. Stimpson in the waters around Boston Harbor, and at Grand Menan. The beautiful Dendronotus arborescens is found in pools among the Algæ at low tide along the shores of Nahant and Swampscott. Eleven species of Eolis are now known. The extreme beauty of some, and *outré* appearance of nearly all, render them objects of great interest. Many are like Caterpillars in their aspect and mode of locomotion.

FAMILY CHITONEIDÆ contains the peculiar multivalve shells, shield-shaped, and composed of numerous pieces. A few small species are found on

shore, but most of them, very small, are taken in the stomachs of Fishes. We have collected fine large species on the coral rocks of Plantation Cay, Florida Reef. Eight species are recorded, in two genera.

FAMILY DENTALIIDÆ embraces the small horn-like tubular shells, with two genera and two species.

FAMILY PATELLIDÆ is represented by two genera and three species, comprising the little "knee-pan shells."

FAMILY CALYPTRÆIDÆ includes the little "Boat-shells," Crepidulæ, and the exquisite little Chemoria noachina. Then the Ianthinas, those beautifully indigo colored waifs that float upon the broad ocean. One species only is known here, and that is cast ashore during gales of wind.

FAMILY TROCHIDÆ has three genera and ten species. *Paludinidæ* has three genera and seven species, found in the fresh-water streams and ponds of New England. *Littorinidæ* number five genera and sixteen species; *Scalariidæ*, one genus and three species; *Turritellidæ*, two genera and six species; and the *Cerithiidæ*, two genera and three species. The beautiful and rare Rostellaria, now called Aporrhais occidentalis, is a prominent species of this family. The exigencies of science have rudely substituted a name of doubtful euphony for the pleasing Rostellaria. The former great rarity of this shell has endeared the old name, as well as its familiar form. A species much like this we have received in considerable numbers, in a fossil state (Post Pliocene), from a friend in Mississippi. *Pyramidellidæ* has four genera and twelve species.

FAMILY VELUTINIDÆ has the delicate little ear-shell (Velutina haliotoidea) which is said to be found among sea-weeds near shore. Formerly it only came to notice through the overhauling of fishes' stomachs, where it is very common, associated with many other small shells that seem to live exclusively in deep water. These shells the Cod and deep-water Fishes feed upon in winter. The *Naticidæ* are notably sizable shells; six genera are known, and nine species. The N. heros, now called Lunatia heros, is a most familiar shell upon the northern beaches; several small species are found in Cod. Family *Turritidæ* has two genera and eight species; *Columbellidæ* one genera and four species; and *Purpuridæ* three genera and eight species. The genus Purpura includes forms that emit the beautiful Tyrian dye. These shells are very abundant on the rocks at Nahant, and the least disturbance of an individual is followed by a flow of the purple fluid, staining the hand very positively, if touched. Dr. Gould well remarks that "While there is an individuality to these shells, by which they are easily recognized, yet there are scarcely two alike in markings, so varied are the stripes, and infinitely varied the details."

FAMILY MURICIDÆ has seven genera and fourteen species; all its members are notable and familiar. The Fusus is a handsome shell; and the Busycon is nearly the largest of the class having a habitation on our shores. The spawn of this shell is particularly interesting; it is found cast upon beaches, and resembles a coil of shaving just from an augur or plane. It consists of a number of discs of membrane, about an inch or less in diameter, strung upon a tough cord; the whole having a spiral form. When the eggs within these discs are mature, a small opening is disclosed in the edge of each, and from this the minute and *perfect* shells emerge. The large species, B. canaliculatum, is sometimes found on the shores of Cape Cod, but is common farther south. The largest of the class is the B. carica; not so elegant in shape, though having more color. Family *Cancellariidæ* has two genera and two species.

Prof Verrill, of Yale College, has given us the following information as to a few species which have lately been determined as inhabiting our coast. Buccinum tenue, Gray; dredged alive in considerable numbers off Cape Sable, Nova Scotia, in eighty-eight to ninety-two fathoms. B. cyaneum, Brug; taken with the last, living, and about equal in abundance. Hitherto it has been considered eminently arctic; others have since been taken off Sable Island. Neptunea propinqua (Fusus propinqus, Alder); a number of fine specimens taken with the preceding. Triopa lacer, Loven; "This interesting addition to our Fauna was dredged in 1877 at several localities in Massachusetts Bay, in forty to fifty fathoms, and off Nova Scotia in eighty to one hundred fathoms. Scyllæa edwardsi, Verrill; a new species, taken in the autumn of 1877 by Mr. Vinal N. Edwards, at Wood's Hole, Massachusetts, on eel-grass (Zostera) in the harbor, and in Vineyard Sound of floating Sargassum.

SUB-CLASS—PULMONIFERA (*Land and Fresh-water Mollusks.*)

FAMILY HELICIDÆ embraces eleven genera and fifty-four species. This is an interesting as well as numerous and familiar group; many are small and inconspicuous, but all have pretty forms. The mouths or lips of the shells are beautifully varied, many of them resembling the configuration of the ears of animals. The Common Helix (H. alternata) is found distributed over the entire portion of Eastern North America; the Post Pliocene beds of the Mississippi Valley are stored with them. H. albolabris is, perhaps, the more familiar, and is handsomer in form; it is also the largest Snail. Its range, both recent and fossil, is the same as the latter. H. hortensis (Garden Snail) has, at one time long since, been introduced into the country from England, where it is very common. It is confined to the eastern portions of New England, and is found as far north as Greenland. It is a beautiful shell, having pleasing colored stripes encircling it, which are subject to great variety. Family *Arionidæ* has only two genera known to North America; four species are enumerated, having the habits of the Helices.

FAMILY PHILLOMYCIDÆ are naked Mollusks, resembling Slugs or Limaces, with one genus and two species. *Auriculidæ* is an amphibious family; most species are found in salt or brackish water. Three genera are known, and as many species.

FAMILY LINNÆIDÆ frequent quiet or sluggish streams and ponds. Many species glide along the surface of the water, shells downward, and let themselves down by means of a glutinous thread. There are six genera and twenty-five species in New England.

CLASS—CONCHIFERA (*Bivalves*).

IN this great division the head is indistinct, and the mouth has elongate fleshy lips or *palpi*. The body is covered with a bi-lobed mantle, each lobe protected by a shelly valve; there are two lamellar gills on each side; the foot is under the body, usually compressed and keeled. The individuals are aquatic and bi-sexual. The more familiar examples of this class are the Oyster and Clam. Though less numerous in species, they are said to be more abundant individually. The habits of some are exceedingly surprising and interesting; the borers and burrowers exhibiting most unexpected powers. The most compact rock is not too hard for the Pholos to penetrate, and the Teredo forces its way through the hardest timber. A recent analysis has determined that acids, capable of softening the rock, are found in the secretions of these boring Shell-fish.

FAMILY PHOLADIDÆ.—This family contains the celebrated Teredo, which proves so destructive to ship timber. Six species are known in our waters. Three other genera are known, and four species.

FAMILY SOLENIDÆ includes the Sword-shell (Solen ensis), and has six genera recorded. The Solemya velum of this family is an exquisitely-formed and colored shell, though of sober colors; the rich umber and chestnut epidermis veiled at the edges. It was always an eagerly-sought prize, being rare. Several others, as Panopea and Glycymeris are found in Fishes caught off George's Banks. The pretty Solecurtis, so common on our beaches, is here placed.

FAMILY MYADÆ.—THE CLAM *par-excellence* in New England, is the Mya arenaria, but as we go farther south it is less esteemed, as well as not so tender nor well flavored. Mya truncata is another species, but little known.

FAMILY CORBULIDÆ has two genera and two species; small and little known. *Pandoridæ* has one genus and one species; a delicate, pearly shell; found in Boston Harbor. *Anatinidæ*.—Four genera. The beautifully-shaped Thracia conradi is of them—a rare shell, seldom found alive. We have a specimen which had a portion of the animal adhering, the first one known to have been procured in that state.

FAMILY MACTRADÆ.—THE GREAT CLAM (Mactra solidissima), so-called on the Massachusetts coast, is the designated representative of this family. Three genera and six species are known. Family *Kelliadæ* contains three genera. Family *Gastrochænidæ* two genera. The Petricola, a burrowing shell, is common on our beaches. Saxicava is found inhabiting solid substances, in holes bored progressively as it grows. Family *Tellinidæ* has two genera and four species. Family *Lucinidæ* contains several rare forms, seldom seen; two genera and three species. Lucina radula was so rare at the time Stimpson published his *Shells of New England*, he regards it as important to record the finding of a specimen alive after a storm. Family *Cycladidæ*.—Two genera and sixteen species. Family *Cyprinidæ* contains the beautiful chestnut-colored and chestnut-shaped Astarte, nine species, and one of Gouldia. Another genus, Cyprina, has one species, the familiar Round Clam of the more northern beaches, which is sometimes mistaken for the Venus mercenaria. The epidermis distinguishes it. Family *Veneridæ*.—Four genera and six species, including the notable Quahog. Venus mercenaria; this shell is not found north of Cape Cod during late years, excepting in a few very circumscribed localities. Family *Cardiadæ* has three genera and six species. Family *Arcadæ* four genera and fifteen species; many of them found only in Fishes from deep water. Family *Unionidæ*.—Fresh-water Mussels or Clams; three genera are recorded and eleven species. Family *Mytilidæ*.—Four genera and nine species, including the familiar MUSSEL of our harbors. Family *Pectenidæ*.—These are embraced in one genus and four species. The Scollop-shell (P. irradians) is found abundantly about Cape Cod. Some ten miles off Portland the Fish Commission dredged a large number of P. islandicus.

FAMILY OSTREIDÆ.—Although nearly last in rank, this is a very important family. Ostrea virginiana is the COMMON OYSTER of Chesapeake Bay. It is occasionally found in the vicinity of Boston, and at the mouth of the St. Lawrence River. Several species are enumerated, but it is believed they are one.

CLASS—BRACHIOPODA.

THE animal of this group has cirrated arms or oval appendages, which are free or united by membrane, sometimes supported by calcareous processes. The class takes its name from the long fringed organs which are attached near the mouth, and are regarded as designed to bring food to the mouth. There are but few species living at the present day, but they are found fossil in great abundance.

FAMILY TEREBRATULIDÆ.—There is but one genus, with one species, belonging to this family. Family *Rhynchonellidæ*.—Two genera and two species are known.

CLASS—TUNICATA.

THE Tunicates are the lowest in organization of any of the *Mollusca*. They have no lime-covering or shell, but are clothed in a sac-like, leathery membrane or tunic; hence the name. They are headless Mollusks, mostly sac-shaped, and having two openings. The viscera are well defined, and the muscular and nervous systems clearly developed. They have no feet nor organs of propulsion, being fixed by a stem to the bottom of the sea or to floating objects. Some are simple, single; others are compound, having several united on one stem, or included in one common frame like the Astræan corals. They are hermaphrodite, and undergo metamorphosis in the young state.

FAMILY BOTRYLLIDÆ.—This is a semi-transparent, gelatinous crust, studded with minute stars, seen on floating timber and sea-weeds. The Rays are separate animals. One species is known in New England waters; one other genus and one species is recorded (Plate 9). Family *Salpidæ*.—One genus, with one species, only is recorded. The Salpa caboti is quite common south of Cape Cod. Family *Ascidiidæ*.—Eight genera and twenty-six species are enumerated as inhabiting our northern waters. Boltenia is a beautiful object. It is frequently thrown upon our beaches during heavy storms. It resembles a kidney, supported on a long stem, or, regarding its fresh, peachy blush of color, it is quite like the Cypripedium or Ladies' Slipper. SEA-PEACH is a common name among fishermen.

INSECTS.

THE class of *Insects*, as presented by Dr. Packard, embraces the following three great orders:

I.—HEXOPODA (*Six-footed Insects*).
II.—ARACHNIDA (*Spiders*).
III.—MYRIAPODA (*Centipedes*).

ORDER I.—HEXOPODA.

In this order the segments of the body are grouped in three distinct regions; there are two pairs of wings; eyes are compound and simple; there are three pairs of thoracic legs, and one pair of jointed abdominal appendages. There is a more or less complete metamorphosis.

The sub-orders, comprising the first and higher series, are *Hymenoptera*, *Lepidoptera* and *Diptera*, which usually have a cylindrical body; a small prothorax; the parts around the mouth arranged more generally for sucking; and a complete metamorphosis. The larva is a very close resemblance to the adult.

The second and lower series of sub-orders are *Coleoptera*, *Hemiptera* and *Neuroptera*, which have the body flattened; the prothorax large and squarish; the mouth parts usually adapted for biting; metamorphosis incomplete; the pupa often inactive; the larva flattened, and often resembling the adult.

SUB-ORDER—HYMENOPTERA.

Bees, Wasps, Saw-flies and Ants are prominent and familiar examples of this group. There are about twenty-five thousand species known, of which five thousand inhabit the United States. A few species have a range as far north as Polaris Bay, where the Humble Bee and several Ichneumon-flies have been found living. *Hymenoptera* have four wings, membraneous and naked; a large head; jaws adapted for biting and seizing their prey, and an arrangement of the mouth parts to facilitate lapping the honey of flowers.

Certain characteristics of development and habits render these Insects entitled to the highest rank in their division. Their social instincts form a marked feature, as well as the fact that the sexes are in many distinct. The anatomy is complicated. There is an organ called the sucking-stomach, which connects with a long œsophagus. By some chemical change, not understood, the honey is produced from the food contained in the crop, and this is regurgitated into the honey cells which the Bee constructs. The wax which forms the cells is secreted in minute glands situated just under the skin; the openings being through pores in the integument. In the Honey Bee these pores are situated on the under side of the abdomen.

FAMILY APIAVIÆ.—The Honey Bee is the familiar form prominent in this family. This highly-prized Insect was introduced into America in the seventeenth century, and is now known over the whole civilized globe. There are enumerated two thousand species of this family. Numerous interesting forms are figured on Plates 7 and 11. The nearest native ally to the Honey Bee in North America is the Humble Bee (Bombus). The Carpenter Bee (Xylocopa) is the largest of the group. It has the power to cut a tunnel into sound wood several inches, or, indefinitely. A pretty piece of its work in the American Museum, Central Park, New York, is exhibited in a billet of sound white pine wood, which the Insect had penetrated its length, about three-quarters of an inch, across the grain, and then bored a smooth, round hole, one to one and a half feet in length. This excavation is done by its sharp cutting jaws. In the cells thus produced the eggs are deposited, one to each, and a quantity of pollen of

flowers carefully introduced for the several larvæ to subsist upon until they are mature. The Ceratina, a smaller borer, is an interesting example, found on the syringa, elder and blackberry. It bores into the substance of the wood and lines the cells with silk. The stages of existences are very short. Dr. Harris relates that he knew of one that laid her eggs in the hollow of an aster-stalk on May 15; three perfect Insects were disclosed from it July 28th. "Late in the spring," says Dr. Packard, "the female builds her cells, fills them with pollen, and lays one or more eggs upon each one. Thus, in about two months, the Insect completes its transformations; within this period passing through the egg, the larval and chrysalid states, and then, as a Bee, living through the winter. Its life thus spans one year." Many other interesting forms, having similar habits, are common to our country-side; the Leaf-cutter Bee (Megachile) and Mason Bee (Osmia) both building and weaving silken upholstery for their interiors.

FAMILY VESPARIÆ (*Wasps*) comprise about nine hundred species. The higher forms are social in habit, and build papery domiciles. The lower are solitary, building nests in mud or sand, in the form of single cells. The Paper-wasps build a series of cells, with or without a papery covering, and usually supported by a short pedicle. The largest, and also most common, of our species is the Spotted Wasp (Vespa maculata); the Yellow Wasp (V. arenaria) is another of similar dimensions. These build papery nests, consisting of several galleries. Like the Bees, the Wasps have parasitic pests to annoy them and feed upon their stores. Wasps are omnivorous to a great extent, but they are also savagely carnivorous. In the early summer they feed much on the sweets of flowers, but later they attack other Insects, and the Honey Bee especially, as it returns laden with pollen from the fields. They tear the abdomen from the rest of the body and feed on the juices. In this encounter the Wasp and Hornets use their jaws, cutting the wings from Flies, and even Butterflies, to devour the trunk.

FAMILY CRABRONIDÆ (*Sand-wasps, Wood-wasps*).—These, as a group, exhibit more independence of action; they build nests or cells in cylindrical holes in rotten wood, or they enlarge mail holes wherein to construct cells for their eggs. The species are very numerous in North America. *Nyssonidæ, Bembecidæ* and *Larridæ* are allied to this family, but not largely represented in species.

FAMILY SPHEGIDÆ.—Species of this family are very ornamental in stripes and colors, and are armed with powerful stinging apparatus. The cells are provided with a store of living Insects for the sustenance of the larva when it comes to the eating stage. The Wasp stings its victim or prey, but this does not kill; thus the larvæ have awaiting them living food, as the wounded Insect lives some days after confinement. The beautiful blue and metallic green species, with golden wings (Chlorion) are closely allied.

FAMILY POMPILIDÆ.—About seven hundred species are known, spread over a wide range, from the temperate zone to the tropics. Like the preceding, they store their nests—usually built in the sand—with Insects wounded by their stings. The Pompilus formosus is called in Texas the Tarantula-killer, from the fact that it deliberately attacks that formidable Spider—the Mygale hentzi. Dr. Lincecum states that it paralyzes the Spider by its sting, and, puncturing it, lays an egg, and buries the creature five inches in the soil.

FAMILY FORMICARIÆ (*Ants*).—Nearly one thousand species of Ants have been described, and over two hundred species of the genus Formica. A curious form, found in Texas, called Honey Ant (Myrmecocystus mexicanus), has the abdomen distended into a large globose, bladder-like form. An agreeable drink is made from its honey by the Mexicans. Dr. Lincecum describes the habits of the Agricultural Ant (Myrmica molefaciens). "It lives in populous communities, building mounds, in which they construct neat cells, wherein they place their eggs and stores of grain. The grain-bearing grass (Aristida stricta) grows near, and all other green growth is cleared away by the Ants, excepting this, which bears a small grain that they gather and store away for food." Several other very remarkable forms are known in the tropical portions of America, the habits of which would require volumes to describe. The families *Chrysididæ* and *Ichneumonidæ* follow here. The latter are regarded as very useful to the agriculturist, as they destroy Caterpillars in great numbers, by puncturing them and laying their eggs within, to be hatched and there find sustenance. There have been two thousand species described in Europe, and it is thought that there are quite as many here.

FAMILY CYNIPIDÆ (*Gall-flies*) is an interesting group which includes Insects that puncture leaves and deposit their eggs within. Galls are developed by an extraordinary change in the vegetable fibre, and the young Insect or larva eats the green substance that has grown around him in his egg-existence; after which he eats his way to the outer world. Baron Osten Sacken bestowed great attention to these forms, as well as to the *Diptera*, and has given his large collection of North American Insects to the American Museum, Central Park, New York, where an excellent opportunity is offered for their study.

FAMILY TENTHREDINIDÆ (*Saw-flies*).—These connect naturally the *Hymenoptera* with the *Lepidoptera*. The larvæ resemble those of the latter, but the perfect Insect is like the former. The Pear-slug is a familiar example of the larva. Other slimy creatures, not pleasing to look upon, are found cutting the rose leaves. Most singular examples of care for their young are told. It is said the female sits watching the hatching of the eggs, and thereafter guards the larvæ from parasitic or other enemies. Some species are found attacking the pine trees. The Pine Saw-fly (Lophyrus) has proved very destructive to young pines.

FAMILY UROCERIDÆ (*Horntails*), so called from the prominent horn situated on the abdomen of the males. An ovipositor extends beyond the horn. They are especially destructive to young trees, particularly pines and firs, by piercing them.

SUB-ORDER—LEPIDOPTERA.

Butterflies and Moths make up the membership of this group. The term which is used to indicate them collectively is from the Greek, meaning "scale-winged." Linnæus first applied it, on account of the presence in the typical forms of small powdery scales upon the wings. It is a character of less importance than some others; but the fact of its long service in the science of Entomology gives it, like a few more equally venerable, a right of tenure that few would now question. The *Lepidoptera* are essentially Flying Insects; they have broad, extended wings, made up of a framework of hollow "veins," within which is an air-tube, around which the blood flows. The form that these tubes take in branching indicates characters that are recognized in the establishment of genera and families. The legs being used only for supports while resting, are not powerfully developed, and are very uniform in size and aspect. The head is small, and the mouth organs but feebly developed, as the food is mostly taken in a liquid state by suction. The thorax is proportionately large, since the powerful muscles that propel the wings require sufficient space for attachment. The antennæ are important organs, and many forms are very beautiful; in feathery adornment in Moths, or knobbed in the Butterflies. Connected with the tongue is what is termed a sucking stomach, which connects with the posterior end of the œsophagus, opening into it. Two long glands, situated along the sides of the abdomen, and opening by a common orifice—in the larva—are those which secrete the silken material. When the Caterpillar is about to change its condition, having matured, these glands are seen to be completely developed. The silk is spun from these receptacles in the form of a glutinous secretion, which becomes thread-like on exposure to the air. There is complete metamorphosis in this group. The larvæ are worms, and the pupæ resemble the adult in most respects. On hatching from the egg the young first eat the shelly covering. These, from the first, bear a pretty close resemblance to the full-grown larva. Several moultings take place during its growth, the worm growing rapidly while freely feeding upon vegetable matter of its particular choice. When the worm has reached its growth it ceases to eat, and commences to spin a silken cocoon, or to gather around it a quantity of dirt or bits of leaves. Cocoons are more or less beautiful and complicated; those of the Silk-worm are among the most perfect. It is estimated that the Silk-worm, in weaving its cocoon, moves its head to and fro, in a zig-zag manner, to place the threads, about 254,000 times. Four or five days are required for this process. There are many cocoons of other Worms that are simply made up of the hairs of the Caterpillar glued together. The structure of the wings of these Insects is exceedingly interesting, and may be well studied and admired by aid of even a small magnifying glass. Under a glass the little "scales" are seen to be like shingles that are placed one upon another, exactly as the latter are on the roof of a house. They are, however, more like the feathers of a bird in their insertion in the skin by the quill portion. Some instances of hermaphroditism are known among the Moths and Butterflies.

FAMILY PAPILIONIDÆ (*Butterflies*).—These Diurnal *Lepidoptera* are distinguished readily from the Moths by their slender and knobbed antennæ. There are about five thousand species known. In North America nine hundred are enumerated. Mr. Scudder records ninety-five species as found in New England. The genus Papilio has over three hundred species. The pupæ of these forms are exceedingly pretty in outline. The perfect Flies of the genera Vanessa and Grapta are among the most elegant in their sculptured wings, notched and angulated in various pleasing patterns.

FAMILY SPHINGIDÆ (*Hawk-moths, or Humming-bird Moths*).—The members of this family are large and stout, and capable of sustaining a steadier and more lengthy flight than the Butterflies. About three hundred or four hundred species are known, a large portion being common to tropical America. The large bird-like Moths seen at dusk around flowers in May and June are prominent examples of this group. The great POTATO-WORM (Macrosila) is one of the largest of the family. The genus Thyrens is especially notable for its beautifully scalloped wings. The body, also, is well defined in outline, as well as large.

FAMILY ÆGERIADÆ is represented by gayly-colored Moths. They are small in size, and have wings much resembling those of Bees and Wasps. A pretty example is the PEACH-TREE ROVER (Ægeria).

FAMILY ZYGÆNIDÆ is interesting as being the medium of connection between the two groups, Diurnal and Nocturnal. The Castnia exhibits strong likeness to the Butterflies.

FAMILY BOMBYCIDÆ includes the largest and most elegant species of the Nocturnal *Lepidoptera*. The Caterpillars are varied extremely in ornamentation. The beautiful Tussock-moth Worms are among them; for example, the Halesidota. Tufts of hair are situated on tubercular spots, which are often highly colored. Some familiar forms are seen on our apple trees and on the garden vegetables. Genus Euclea is stout and woolly, and is represented by a species which we have seen in Central Park, N. Y., feeding upon the Syringa. Packard named it E. monitor, from the fact that the curious brown saddle-like spot on the back, which reminds one of the "cheese-box" or turret. Its body is very regularly elliptical, thus resembling the hull of a vessel. The genus Attacus embraces some of the largest species of Insects; one form (A. atlas) found in China, spreading nine inches in breadth of wings. The silk obtained from these Insects forms an extensive article of commerce, and efforts have been made to introduce some foreign species into our country for the purpose of raising this product. Some species in Central America afford good cocoons of this valuable article.

PHALÆNIDÆ—The GEOMETER MOTHS have larvæ of peculiar habits. Some are so developed that they progress in the form of a loop. The Inch-worms are an example.

SUB-ORDER—DIPTERA.

The Common House-fly belongs to this order of two-winged Insects, which has the mouth formed as a sucker, constructed of from two to six lancet-shaped elongated scales, enveloping a canal upon the upper surface of a fleshy proboscis. The larvæ generally have a membraneous head; the stigmata or breathing-pores are always placed in the second and terminal segments of the body. In some species, such as the Blow-fly, the eggs are hatched within the parent; in others, like the Forest-fly, the larvæ are metamorphosed within the body of the parent, and the young are excluded as pupæ. There are about two thousand five hundred species of Flies in North America, already described, and probably double that number are likely to be found. Their habits have not been studied in this country, though many present very interesting phases.

FAMILY CULICIDÆ (*Mosquitoes*).—The larvæ of this family are active, and have swimming organs, remaining mostly at the bottom, feeding on the decayed vegetation. They destroy immense quantities of matter, which would otherwise prove a serious source of disease. The genus Culex abounds in quite northern latitudes, as well as in more warm regions.

FAMILY CECIDOMYIDÆ includes the Gall-flies, minute and slender species, with hairy bodies, the female of which punctures and lays her eggs in the limbs of trees and plants, causing a growth of gall-like excrescences. The notorious Hessian Fly and the Wheat-midge belong to this family. *Tipulidæ* (Daddy-long-legs); *Pulicidæ* (Fleas); *Tabanidæ* (Horse-flies); *Œstridæ* (Bot-flies); *Muscidæ* (House-flies); *Hippoboscidæ* (Forest-flies); *Nycteribidæ* (Bat-ticks), and several other families of less familiar forms, are ranked here in order.

SUB-ORDER—COLEOPTERA.

These sheath-winged Insects are commonly known as Beetles. It is estimated that there are more than eighty thousand species, of which over eight thousand are known to inhabit the United States. About one thousand fossil species have been recorded, being found as low down as the coal formation, though more common in the Tertiary.

SUB ORDER—HEMIPTERA.

This sub-order—signifying half-winged—includes the true Bugs, Plant-lice, Bed-bugs, Body-lice, etc. "The mouth parts are formed into a slender horny beak, consisting of a horny sheath enclosing three sharp bristle-like organs, the whole being fitted for a sucking apparatus."—*Packard.* About twelve thousand species, living and fossil, are enumerated.

SUB-ORDER—ORTHOPTERA.

These Insects are straight-winged and do not undergo a complete transformation, but pass by insensible gradations from the larval to the adult stage, all the while remaining active. The Walking-sticks and Walking-leaves (*Phasmidæ*), the Locusts and Crickets (*Gryllidæ*) are all notable members of the order, the Grasshopper being the type. About five thousand species are known, the larger number being found in tropical countries. Fossil species are found in the Upper Devonian, some in carboniferous rocks, and large numbers in the Tertiary. They are found abundantly in amber.

SUB-ORDER—NEUROPTERA.

This order of nerve-winged Insects embraces most distinctively-formed species, distinguished by long bodies and slender wings of delicate net-work. They have very large eyes and strong mandibles. Having no sting, they depend wholly upon their jaws for weapons. In the larval state they are mostly aquatic, and do not undergo a complete metamorphosis. The larvæ of White Ants, or Termites, which feed upon wood, and prove very destructive to the furniture, and, it is said, also, to the houses of the residents of warm climates; the Ant lions, whose larvæ feed upon Ants and other insects; and the little Bristle-tails, seen running over old books, belong here.

ORDER II.—ARACHNIDA.

Members of this order have the body divided into two well-marked regions, the head and the hind-body, the thorax being merged closely in the head. They have simple eyes, four pairs of legs attached to the thorax; they are without antennæ, compound eyes and wings. They do not change in coming to maturity, but moult their skin six times during their growth. In the group *Pedipalpi* are found the odd creatures called Daddy-long-legs or Harvest-men, the Scorpions and False Scorpions. *Acarina* embraces the colony of Mites, Ticks, Water-mites and the various forms of *Acaridæ*. The Spiders proper are included in the group *Araneina*, of which *Territilariæ* is a sub-order indicating "under-ground weavers," or

TRAP-DOOR SPIDERS.

Small Spiders which construct trap-door domiciles are not uncommon in North America, but the discovery by Prof. Holmes, of Charleston, S. C., of a gigantic species on his plantation in that State caused some surprise. The specimen, which includes the young with the nest, is in the American Museum, Central Park, New York. The body of the Spider is larger than an ordinary Mouse; the legs are short and stout, and covered like the body with coarse hairs. The nest is so constructed that it was easily separated and lifted out of the earth, remaining intact like an adobe structure; the tube is about seven inches long and nearly two inches in diameter. Unlike other Spiders, this creature does not weave a web, but depends upon the gates and bars of his castle, which he defends with astonishing power. The ground is not only excavated for his purpose, but it is opened as a stone-mason works: instead of plas-

tering on the sides of the excavation he digs a large hole, and then commences at the bottom to build a wall of mud, which on completion forms a tube. This is lined with silken threads, woven so as to hold the material and render the nest impervious to dampness. At the lower end there is a small opening sufficient to let off any water that may get in from the top.

There are four principal types of trap-door nests; two of them exhibit two doors each, one door being some distance underground, while the other is always on the surface. All are constructed under ground in an excavation made by the creature, and in every case lined with silken threads, which are so closely woven as to resemble the finest satin. In one instance, that of the West Indian species, the door is wholly constructed of silk, without admixture of earth, lying on rather than fitting into the aperture of the tube. In others the door is made of the same material as the tube, of layers of earth and silk, and so contrived that it fits closely like the stopper to a bottle, the mouth of the tube being bevelled to receive it. The Spider builds this interesting dwelling by first excavating a hole in the earth, which is carefully fashioned to a cylinder shape; with her jointed fangs she carries the bits of earth out as they are dislodged. The silk is now spun out and attached on all sides, forming an even continuous lining. The mouth of the tube is dilated a little to allow of the close fitting of the trap, which is hinged very delicately by a woven patch of silk. Within the tube and near the upper portion are minute punctures which have puzzled observers. Mr. Gosse is inclined to think that in the case of the West Indian specimens, which he observed, they were made to give air to the otherwise air-tight cavity. Others think they are simply the result of a hold which the Spider exerts while defending the entrance from intruders. Nests are almost invariably placed on sloping ground, so that the door may fall by its own weight when opened. Much difference of opinion exists concerning the action of the Spider when assailed from without.

Mr. Moggridge, in his work on *Trap-door Spiders and Harvesting Ants*, says: "No sooner had I gently tapped the door with the point of a penknife than it was drawn slowly downwards with a movement which reminded me of the tightening of a limpet on a sea rock, so that the crown which at first projected a little way above, finally lay a little below the surface of the soil. I then contrived to raise the door very gradually, despite the strenuous efforts of the occupant, till at length I was just able to see into the nest, and to distinguish the Spider holding on to the door with all her might, lying back downwards with her fangs and all her claws driven into the silk lining of the under surface of the door. The body of the Spider was placed across, and filled up the tube, the head being away from the hinge, and she obtained an additional purchase in this way by blocking up the entrance."

Some specimens of Trap-door Spiders, with their nests, from Mentone, France, are in the American Museum, New York. The nests show the curious stopper-shaped traps, which, in common with the surrounding soil, are covered with a thick growth of mosses. The traps are exactly circular, and fit so closely that they look as if they had been cut out of the earth with a sharp punch. A common form of the Mentone nest has a branch, or second tube, which joins the main at an angle of about forty-five degrees. The branch sometimes reaches the surface, but is usually a *cul de sac*. Every part of the work of these creatures challenges our admiration and astonishes us with that which so resembles the operation of mind. In the construction of this second tube there is a wonderful exhibition of design. The opening into the second tube is closed by a trap-door similar to the outer one, and it is hinged to the sharp angle which is formed by the union of the tubes; the door is then used to fit either tube; it either closes the creature in the *cul de sac* or in the lower portion of the main at his will. The uses of this second tube are not quite clear. It is noticed that the young build in the same manner, some nests being so small that a wheat-straw will fill them. The ingenuity of the Spiders is sometimes at fault. Generally the lichens remain quite green upon the surface of the cork trap-covers, but in some instances the latter become dry and the vegetation dies; this is readily seen, but the creature tries to remedy it by introducing bits of leaves, even freshly-cut leaves (usually dried ones), and bits of sticks, straw, etc. This is almost parallel with the example of an Aphrodite-worm which we have often seen building its tube in the warm waters of the Florida Reef. The latter creature selected from the surrounding *débris*, after excavating a tunnel in the mud of the shallow lagoon, certain calcareous fronds of Algæ, which like so many little bricks it laid in regular manner one upon the other, until a well had been built to the surface. In the work, at various points, fragments of sea-moss were introduced to hide its regularity, several inches of the tube being built above the surface. We wonder how it is that so low an organization as this simple Worm can select from a mass of refuse matter on the sea bottom this *one* kind of material, and make use of it as accurately, and in the same manner, as a stone-mason builds his "faced-wall." In this instance the little plates of lime, which have lost their vegetable covering by decomposition, are laid evenly upon each other, the whole tube presenting perfectly smooth and regular walls on the inside, which is also further finished as a mason plasters, by filling the joints with a kind of cement.

Mr. Moggridge says: "The nests are enlarged as the growth of the Spider requires; the young constructing just as perfect ones as the old. I cannot help thinking that these very small nests, built as they are by very minute Spiders, probably not very long hatched from the egg, must rank among the most marvellous structures of the kind with which we are acquainted. That so young and weak a creature should be able to excavate a tube in the earth many times its own length, and know how to make a perfect miniature of the nest of its parents, seems to be a fact which has scarcely a parallel in nature." These large Spiders

have a formidable weapon in the poison fangs or claws, the two foremost ones being provided with tubes which lead to a gland at the base. A sudden blow from the fangs forces out the poison, and it is conveyed into the wound through the minute opening at the end. Madame Merian, in her book on the *Insects of Surinam*, furnishes a description of the great Mygale avicularia of South America, introducing a figure of the creature in the act of eating a young Humming-bird. It sallies forth at night, seldom making its appearance by day. Its muscular force is exceedingly great, and it is particularly difficult to make it let go objects which it has seized. A Tree Lizard is a common kind of prey for it; when holding one of these it exhibited so much obstinacy as to retain its grip, notwithstanding its body was pierced through and through repeatedly. See vol. ii, p. 277, fig. 178.

ORDER III.—MYRIOPODA.

In this order the body is cylindrical, worm-like; the segments are not grouped into regions, except in the recently hatched young. The head is free, the eyes are simple, and there are antennæ, but no wings. The yelk-sac is present for a short time after hatching, and there is no metamorphosis. The dreaded Centipede is the type. Several smaller species, entirely harmless, are found in the Northern States. The former is common in Florida and the Gulf States, and is poisonous in the same degree as a Wasp. The Ear-wig (Lithobius americanus) is allied to the Centipede (Scolopendra).

CRUSTACEA.

THE Crustaceans are usually divided into *Decapods*, *Tetradecapods*, *Entomostracans* (including *Cirripeds*) and *Rotifers*, and include all articulated animals which have the head and thorax merged in one; hence the term *cephalothorax*, used to distinguish this union of parts.

Decapoda.—This order of ten-footed Crustaceans is the highest in development, and is divided into three sub-orders, viz: *Brachyurans*, *Anomurans*, *Macrurans* and *Gastrurans*. The first of these is represented by the FIDDLER CRAB (Gelasimus vocans) and the AMERICAN EDIBLE CRAB (Lupa dicantha). The latter is found along the whole coast. It moults once a year, during which time, the new shell being exceedingly tender, great numbers are sold as "Soft-shell Crabs," and are much esteemed as food. Some species are provided with swimming oar-shaped feet, and live mostly on the ocean, upon sea-weeds.

The *Anomurans* include the curious Hermit Crabs, with abdomen unprotected by a hard covering. They adopt the shells of dead Mollusks. On the Florida Reef we have met with a marine species so large that it required the shell of the Triton, or the great Horse-conch. A large Land Hermit, which occupies a shell about the size of a man's hand, is of a bright-red color, with stout arms which effectually fill the entrance to its castle, burrows under houses like a rat, and becomes domesticated. One came to be familiar to our office in Fort Jefferson, Tortugas, and regularly entered, and climbed the corner post of a book-case to sip water from a dish, carrying with him his heavy adopted shell (a large Trochus). This individual was sent to New England, where it lived a year, moulting its own shell twice, always retaining its borrowed one. It became so far tamed that it fed from the hand.

In a *List of Crustacea of the Southern Coast of New England*, prepared by S. J. Smith and P. Harger, three species of Gelasimus are recorded, and in fifteen other genera nineteen species are enumerated, belonging to this sub-order. In *Macroura* nine genera and nine species are recorded, which includes the AMERICAN LOBSTER (Homarus americanus), Crayfishes, Shrimps and Prawns. *Squilloidea* includes one genus and one species; *Mysidea*, three genera and four species; *Cumacea*, two genera and five species; *Amphiopoda* embraces twenty-nine genera and forty-two species; *Isopoda* has fifteen genera and twenty-two species.

Entomostraca.—In this group there are enumerated twenty-one genera and thirty-nine species. The familiar HORSE-SHOE CRAB is of this order. *Annelida* and *Scolecida* have large numbers recorded. The species will be found described in *U. S. Com. Report on Fisheries for* 1871–2.

RADIATA.

IN many of the representatives of this the last of the four great primary groups, into which Baron Cuvier divided the Animal Kingdom, the plan is of the *radiate* character; and hence the selection of the term *Radiata*—radiated animals. Five classes were recognized, viz: 1. *Echinoderms;* 2. *Entozoans;* 3. *Acalephs;* 4. *Polyps* (including *Polyzoa*); 5. *Infusorians.* The latter class has since been separated by reason of incongruity with the remaining *Radiates*, and H. Milne Edwards suggested that the *Polyzoans* and *Gephyreans*, also, be removed, and that the group be arranged thus: *Echinoderms*, *Acalephs* and *Polyps.* The latter classification has been adopted by many naturalists, especially those of France and America.

Radiates are all aquatic, and, with few exceptions, marine; and constitute the lowest branch of the Animal Kingdom. It is estimated that there are at least ten thousand species living, besides an unnumbered multitude of extinct and fossil forms. The vast numbers of invertebrate forms which are crowded in the various geological formations of our own country alone, as exhibited in the great Geological Hall of the American Museum, New York, impress the mind with surprise.

CLASS—ECHINODERMATA—(*Spiny Skins*).

This, the highest form of *Radiata*, includes five orders: *Holothurians*, *Echinoids*, *Asteroids*, *Ophiurians* and *Crinoids*.

HOLOTHURIANS—(*Sea-cucumbers*).

One species of Holothuria, found on the Florida Reef, is much like that used by the Chinese, and called Trepang. This species has a peculiar and very strange parasite. It is found when the Holothuria is lifted from the water, or after it has been kept out of water for a few minutes, that there is a Fish within its alimentary canal. If the Holothuria is placed in water, fresh, it soon disgorges the seeming intruder, which is a purely natural parasite. The Fish is about five inches long, of a pearl color and transparent, the internal parts being easily seen through its sides.

PENTACTA (*Pentacta frondosa*) is a very rare form, excepting on the colder portions of the shore. At Grand Menan they are abundant upon the rocks near low-water mark.

CUVIERIA (*Cuvieria squamnata*) is the most beautiful of the *Holothurians*. A coating like mail, of imbricated plates of lime, covers nearly the whole body; a flat surface being left free and smooth upon which the animal glides in locomotion. On this flat surface are three of the ambulacral rows only. The plates, which cover all other portions except the mouth, are of a beautiful scarlet color, or, in some instances, a deep crimson. When taken from the water this creature, like the Polyps, contracts and draws within all the soft parts, but when undisturbed it produces from its mouth an arborescent wreath quite as long as the body itself, and of great beauty of form and color. The young are found swimming about freely, and are of the same brilliant vermilion color. On the New England coast the Cuvieria is not a familiar object, as it is found in deep water. The fishermen occasionally bring them up on their lines, and they are often found in the stomachs of Fishes. The young that are just developing the limestone armor are found plentiful under the stones at low-water mark.

CAUDINA (*Caudina arenata*) is one of the most abundant, yet it is seldom seen except after heavy storms, when it may be found in great numbers upon the sandy beaches of New England. It lives in the sand. By some it is compared to the human finger, on account of its resemblance in shape and color. The mouth is a simple aperture in the middle of the truncate head. The latter is bordered by a row of short clove-shaped tentacles.

SYNAPTA (*Synapta tenuis*).—This form is long and cylindrical, with a curious transparency which allows the internal structure to be seen distinctly. The mouth is formed like a circular tube, which encloses a row of arborescent tentacles. For so delicate a creature its food is peculiar, consisting of sand and shells; the nutritious matter being digested and the coarser portion ejected. The body is often several feet in length, and is shortened frequently by the separation of portions of its posterior parts, as seen in the case of the Star-fishes.

ECHINOIDS—(*Sea-urchins*).

The Sea-urchins have a more or less spherical or discoidal shell, composed of plates that bear tubercles on which spines are articulated. The surface is composed of ten zones of two widths, alternating. The spines are mostly borne on the larger zones, and the narrow ones bear the suckers.

SEA-URCHIN (*Toxopneustis drobachiensis*) is one of the most familiar species of the Echinoderms. It is abundant on the coast of New England, where it is known as the SEA-EGG, being found at low tide on the rocks and along shore. Like many of the Fishes their size increases as the colder regions are reached. They are usually known as a moiety of the great masses of ocean *débris* thrown upon the beaches after heavy storms. They have a habit of covering themselves with sea-weed, which serves to conceal them.

ECHINARACHNIUS (*Echinarachnius parma*).—This form is not so familiar. To those who frequent sandy beaches it is known as "Sand-cake," being flat and round. The color is dark brown, and the spines are very small and silky. To many it is known only as a perfectly smooth, flat, round shell, having a wondrously regular sculpture on its more convex surface, the minute spines being easily rubbed off, especially after the death of the animal. Probably no form on our shores so mystifies the observer; the extreme thinness of the creature naturally precludes the idea of a living thing; yet, the same organs are there—the ambulacral tubes or suckers—and the interior is on the same plan as that of the Sea-egg. The teeth of this species are not so complicated by muscular apparatus.

ASTEROIDS—(*Star-fishes*).

In the structure of the Sea-urchin it is seen that at the termination of the zones, near the mouth, are the eyes. In the Star-fish we find the eyes, one upon each ray, at the end—as if the rays of the Urchin had only to be unfolded and flattened to constitute a Star-fish!

STAR-FISH (*Astracanthion berylinus*) is the most common form on the New England coast; being abundant in every bay or arm of the sea, where it is seen clinging to the rocks just above low tide. PINK STAR (A. pallidus), the only other species of this genus, is much less familiar, as it is found in deeper water.

CRIBRELLA (*Crebrella oculata*) is a small Star, inferior in structural rank to the preceding, but beautiful in color, some having a rich Tyrian purple, others a vermilion or bright orange.

HIPPASTERIA (*Hippasteria phrygiana*).—This is a rare form; occasionally fishermen bring up living specimens from deep water, and they are sometimes found on the beaches after heavy storms in the winter months. They are not armed with the spines so common to the ordinary Star-fishes, but have smooth warts. Their color is usually a brilliant vermilion.

CTENODISCUS (*C. crispatus*).—This form is most common in the colder waters of the northern coast. The generic term is derived from the resemblance of its under surface to the parts of a fine ivory comb. The peculiar structure of the ambulacra is thought to have some relation to the habit of living in the mud. It is destitute of the sucking-disks, so common to others of this class, and the tentacles are pointed, as if to facilitate working through the mud.

SOLASTER (*S. endeca*) is a species common to the coast of Maine, in company with the Crossaster. The color is varied, in this respect resembling the Cribrella, as well as in the structure of the spines.

OPHIURIANS.

This order has few examples represented in our waters. They are all very shy, hiding in the darkest crevices in the rocks. No eye-specks, like those on the common Star-fish, have been detected; yet they must be very sensitive, as the slightest movement or the gentlest approach causes them to retreat to their shelter. Unlike the Star-fishes, they have the disk entirely distinct from the arms, or rather, the arms seem to start abruptly from the central body, instead of merging gradually into it.

OPHIOPHOLIS (*O. bellis*) is one of the few forms of this order found in northern waters; it is brought from deep water by the fishermen, and is found in the Fishes caught along the shore. It is not seen on the beaches. White Amphiura (Amphiura squamata) has long slender arms.

ASTROPHYTON (*A. agassizii*), also called the Basket-fish, is one of the strangest forms found in our waters. It is exceedingly rare, and is doubtless a deep-water creature and somewhat exclusive, as it seldom appears in company with other members of its race, or with any denizen of the deep. Its wonderful mass of entangling arms probably serves it to hold fast upon the bottom when other forms are torn away by the swaying of the heavy sea. In 1670, John Winthrop, Governor of Connecticut, sent a specimen of this Radiate to the Royal Society of London. "This Fish," he says, "spreads itself from a pentagonal root which encompasseth the mouth (being in the middle) into five main limbs or branches, each of which, just at issuing from the body, subdivides itself into two, and each of these ten branches do again divide into two parts, making twenty lesser branches; each of which again divide into two smaller branches, making forty in all; these again into eighty, and then into one hundred and sixty, and then into three hundred and twenty, then into six hundred and forty," etc., etc. The governor goes on until he concludes by adding, "into eighty-one thousand nine hundred and twenty, beyond which the further expanding of the Fish could not be certainly traced."

CRINOIDS.

This order is one of a past geological age, there being few species now living. For a time they were the sole representatives of their class, and were so numerous that the one order was as important in point of variety as the present five are in this age. The living examples are the Pentacrinus, found in Porto Rico, and the Comatula. The former is attached permanently to a stem which is fast upon the sea bottom; the latter is fixed in early stages of its growth, but is free when adult.

COMATULA (*Alecto meridionalis*) is found on the coast of South Carolina. When spread out the upper surface has the aspect of an *Ophiurian* resting on a central pivot or stem. Along the sides of the rays are appendages which give them an appearance of feathers; hence it is called Feathery-star. On one side there is a tough skin from which project the ambulacræ; and on the same side are situated the mouth and anus. Opposite, the disk has plates, which are arranged around a central piece; the latter is beset with long *cirri*. A large species is found on the coast of Greenland, and is occasionally brought from near Eastport, Maine.

Class—ACALEPHÆ—(*Jelly-fishes*).

For a long time the true structure of these transparent, almost invisible, creatures was a mystery. The investigations of Sars, Dujardin, Steenstrup and Van Beneden have given an understanding of their anatomy and of their strange modes of growth and reproduction. Three orders are now recognized, the highest being *Ctenophoræ*, the next *Discophoræ*, and the other includes the *Hydroids*.

CTENOPHORÆ—(*Comb-bearers*).

This order is so named because the organs of locomotion (which are arranged in the form of the slats to a blind, in several vertical rows) resemble the teeth of a comb in appearance. Their form is beautiful, with the additional attraction of a constant play of iridescence upon the little paddles. Some species are so transparent that they can scarcely be seen, but the rippling lines of prismatic hues are distinctly visible while the creature is in motion.

PLEUROBRACHIA (*P. rhododactyla*) is graceful and regular in form, and very common to the waters on the New England coast. Though so globular, this species is yet a little lengthened, and is regarded as exhibiting a tendency to a bilateral character. There are two curious appendages, like long tentacles, suspended from either side of the body.

BOLINA (*B. alata*).—This is slightly oval in form, and differs from the preceding, in having two lobes, capable of entirely concealing the mouth.

IDYIA (*I. roseola*) is the lowest genus found on our coast. It has neither lobes nor tentacles, but is an ovate bell-shaped body, with a large digestive cavity and a correspondingly large mouth. The eye-speck is surrounded by a delicate fringe, forming a rosette at the end of the body.

DISCOPHORÆ.

The forms of this order are familiar, and include the Common Sun-jelly and Sea-nettles, which are

found cast on the beaches. They are tough comparatively—some seem almost like cartilage—yet, when dried in the sun, they leave a mere film, hardly discernible. A specimen weighing about thirty-four pounds lost ninety-nine per cent. of its original weight after exposure to the sun. The *Discophores* are distinguished by their peculiar reproductive organs. These are arranged in pouches, and, when spawning takes place, the eggs are discharged into the stomach, and through it out of the mouth. The nutritive tubes form a net-work near the periphery more complicated than the simple circular tube of the *Hydroids*. See *Acalephæ*, Plate 2, figs. 1, 3, 4, 5, 6.

CYANEA (*C. arctica*).—This is the largest and most familiar species of Jelly-fish on our shores. The tentacles are numerous, rising in eight distinct trunks from the margin of the body, and hanging below in a maze of slimy entangled feelers. Behind the veil of tentacles, and partly hidden by it, are four curtain-like appendages, lobed and ruffled on their margins, hanging down from the under surface. The ovaries are contained in four pendant pouches near the mouth, and are connected with four cavities within the body. Eight eye-specks are situated on the periphery of the body; each of these is a small tube placed under a protecting prominence upon the upper side of the disk. This Jelly is usually of a brownish-red, often of lighter shades, with a light creamy-colored margin, slightly tinged with blue.

Madame Agassiz, describing a specimen seen near Egg Rock, Nahant, of such magnitude that it is well entitled to be held as of historic interest, says: "Encountering one of these huge Jelly-fishes one day, when out in a row-boat, we attempted to make a rough measurement of its dimensions on the spot. He was lying quietly near the surface, and did not seem in the least disturbed by the proceeding, but allowed the oar—eight feet in length—to be laid across the disk, which proved to be about seven feet in diameter. Backing the boat slowly along the line of the tentacles, which were floating at their utmost extension behind him, we then measured these in the same manner, and found them to be rather more than fourteen times the length of the oar, thus covering a space of some hundred and twelve feet. This sounds so marvellous that it may be taken as an exaggeration; but though such an estimate could not of course be absolutely accurate, yet the facts are rather understated than over-stated, in the dimensions here given. And, indeed, the observation was more careful and precise than the circumstances would lead one to suppose, for the creature lay as quietly while his measure was taken as if he had intended to give every facility for the operation. This specimen was, however, of unusual size; they more commonly measure from three to four feet across the disk, while the tentacles may be thirty or forty feet long." We may well regard such a huge form with caution and dread, as these animals have the stinging apparatus, which in some species is so potent as to produce death when brought in contact with some large Fishes.

AURELIA (*A. flavidula*).—This is seen in many sizes, reaching the diameter of fifteen inches. It is nearly colorless and transparent, and decomposes so readily when thrown on shore that it escapes particular notice. At times the surface of the sea is fairly occupied by individuals of the species, and hence it is more commonly known to those who "go down to the sea in ships."

CAMPANELLA (*C. pachyderma*).—This interesting and diminutive creature shows a marked contrast in its dimensions compared with the forms preceding, being no larger than a pin's head. It is a direct product of the egg, without passing through any other phases of life.

CIRCE (*Trachynema digitale*) is a bell-shaped form, about an inch in length, having a cone-like termination at the upper extremity. It is hard and horny to the touch, the veil being a thick-folded membrane; the body is a delicate rose-color.

LUCERNARIA (*Halyclistus auricula*), found on the Eel-grass on our northern shores, is of a flaring bell-shape, with a stem-like process at the top, by which it attaches itself to sea-weeds. It is free, however, to float or propel through the water. The color is aquamarine, varied in some by a tinge of red or brown. Its tough membraneous consistence gives it an aspect different from the ideal Jelly-fish, and more like the Actinias or Sea-anemones.

HYDROIDS.

This order includes the lowest forms of *Acalephæ;* those which early in life attached themselves to marine objects by a stalk like a cluster of vegetation, or are permanently so situated. *Hydroids* put forth upon their stalks, buds which grow to be Jelly-fishes, and these break off in some instances to become free-swimming animals, while others remain permanently on the parent stalk. The process called "alternate generation" is here seen: the buds of the *Hydroids*, whether free or fixed, produce eggs in their turn, and perpetuate this remarkable cycle of existence.

Recent investigation has ascertained that the Millepore, so abundantly associated with the Corals of the Florida and other Reefs, is a Hydroid Acaleph. This discovery proves that these Jellies lived in early geological times; and a large number of fossil Corals are now enumerated as the solid parts of *Acalephs* or *Hydroid Polyps*. With the exception of those forming Coral masses, such as the Millepore, *Hydroids* are short-lived. *Polyps* proper live many years; and Star-fishes and Sea-urchins require ten or fifteen years to attain full size. The *Acalephs* complete all their changes and their existence in one year. Breeding in the autumn, the eggs grow to be *Hydroids* during the winter; in the spring the Jelly-fish is free from the Hydroid stalk, or developed upon it; in the fall it reaches its full growth and is an adult animal, dying and floating upon the shore after having cast forth its store of eggs. *Hydroids* are divided into eight sub-orders, forty-six families, and about one hundred and thirty genera.

EUCOPE (*Eucope diaphana*).—This is a delicate little Jelly-fish, and one of the most common and beautiful on our shores. Nothing in microscopy is

more interesting than the exhibition of this pretty form magnified to about fifty diameters. The cells are perfect little wine-glasses, both in form and glass-like appearance.

OCEANA (*Oceana languida*) measures from one to two inches in diameter in the adult, and is so transparent and delicate that it is not readily seen. It is slow and languid in its movements, remaining in deep water, except when the sunshine is most intense. Its Hydroid source is a Campanularia.

CLYTIA (*Clytia bicophora*) measures about half an inch in diameter, and is closely allied to Oceana. It is nocturnal in its habits, more active than the latter, and easily recognized by the black base of its tentacles.

ZYGODACTYLA (*Zygodactyla grœnlandica*).—Brandt gives this genus the name of Twin-finger; hence the Greek term used here. This species is found on our coast, and measures about eight inches in diameter. The disk is of a light-violet color, delicate and transparent.

TIMA (*Tima formosa*).—The robust and solid nature of this genus is peculiar, yet it is as transparent and delicate as the other forms. The adult is about two inches in diameter, is very active, moving with much grace and precision.

LAOMEDIA (*Laomedia amphora*).—"The Medusæ of the Campanularians are not all free. On the contrary, in many of the species they always remain attached to the Hydroid, never attaining so high a development as the free Medusæ, and withering on the stem after having laid their eggs." Such is the subject of this description. The species inhabits the piers of the bridges over the Charles River, Boston, and measures from twelve to eighteen inches in length.

SERTULARIANS.

This is another group of *Hydroid Polyps* closely allied to Campanularia, though differing from them in the arrangement of the sterile Hydræ upon the stem. They are graceful in form: some are like miniature trees, and others hang like streamers from the great Laminarian sea-weeds. Dyphasia pumila is very abundant on weeds at low-water mark. TREE SERTULARIA (D. rosacea) is the branched species. The Medusæ of both these species wither upon the stalk. Lafœa cornuta is the only one known in the adult state.

TUBULARIANS.

This is a small group of larger individuals than the preceding, and embraces forms whose head has a simple wreath of coronal tentacles, and a proboscis with simple tentacles around the mouth. Some of them grow singly, like the Hybocodon, which grows several inches high. TUBULARIA (T. couthouyi) resembles a small palm-tree, with its rings or scars of growth on the stalk, and its top of leaf-like organs, from whence hangs a bunch of undeveloped buds of Medusæ. BOURGAINVILLIA (B. superciliaris) is bell-shaped; the tentacles are numerous, but fine and thread-like. SARSIA (Coryne mirabilis) is a small bell-shaped Medusa, named in honor of Sars, the zoölogist, which grows in patches on the rocks between tides. The adult is about half an inch in diameter, pear-shaped, with a long proboscis protruding through a wide circular opening at the truncated end; there are four long slender tentacles. MELICERTUM (M. campanula).—The disk and tentacles are yellowish, and the eight ovaries of a darker shade; its diameter is about one inch. HYDRACTINIA (H. polyclina) was long known in little colonies on the shells inhabited by Hermit Crabs. They have since been found attached in great masses, having the appearance of soft moss or cut velvet, to rocks in the tide-pools of our bays. They are of a rosy color. HYBOCODON (H. polifer) derives its name from its unsymmetrical shape, one large tentacle only being developed. DYSMORPHOSA (D. fulgurans).—In this genus the buds come from the proboscis; the species is common, and produces the bluish phosphorescence noticeable occasionally on the sea. NANOMINA (N. cara) is when young a single Hydra, with an oblong bubble-like appendage. It is very simple, being almost wholly a digestive cavity. Where the bubble joins the body, numerous buds are produced, which rapidly assume the shape of separate Medusæ. The bubble acts as a float to support the structure in the water.

SYPHONOPHORIANS.

PHYSALIA; PORTUGUESE MAN-OF-WAR (*P. arethusa*).—This belongs to the group *Syphonophora*, which consists of free-moving communities, each made up of individuals of different kinds, yet all appearing to form one complicated animal. The species is one of the most remarkable of the group. The rich purple and blue which decorates every portion except the crest, renders it the most brilliant and showy object on the ocean. Its most conspicuous portion is a floating bladder, with a delicate ruffle-like crest, pearly in lustre and color. *Acalephæ*, Plate 2, fig. 2, exhibits a species of Physalia; but the American one, which is common to the shores of the Gulf States and along the Gulf Stream to Cape Hatteras, is larger, more symmetrical and pleasing in shape. During a long residence in Florida we had many opportunities to examine this beautiful object. By means of a "water-box," which renders the surface of the water perfectly smooth, we were able to view the action of the tentacles of the Physalia, and found to our surprise these dreaded organs surrounded by several small Fishes of a blue color, which looked so much like the shade of the Hydroid itself that we thought them part and parcel of it; and indeed they are in one sense. In lifting the animal from the water, which can be done with impunity by seizing it by the crest, the Fishes dart away; but by carefully surrounding the tentacles with a bucket, the Fishes can also be secured. It seems remarkable that an animal possessed of the power of killing Fishes larger than these little companions, allows them to remain unharmed and like a part of the establishment, and that such a highly organized form as a Fish should be a parasite to such a simple creature.

CLASS—POLYPI—(*Polyps*).

An idea of the *Polyp* is readily obtained from the Sea-anemone; all *Polyps* are much like that, either small, in colonies, or large, in single groups. There is an analogy between the Polyp and the Garden Aster, though the resemblance is not homological. The Sea-anemone may be said to imitate the Aster, in having a row of petal-like organs around a centre, its mouth; and in some cases the coloring is so fine that the difference between the two can be observed with difficulty. The similarity is less observable in the body, however, which in the *Polyp* is large and fleshy. A species of Campanularia found on our shores has more the real flower-like aspect than any other; its petals are highly colored and diversified in form, and the stem is slender, proportionately, like that of the garden plant.

HALCYONOIDS.

This is the highest group of the lowest class of *Radiates*, and is represented in the waters of the Northern States by one genus. The tentacles of these forms are limited to eight; many of them are quite complicated, being divided and lobed, and presenting a curiously fringed aspect resembling moss. They live in deep water, attached to the dead shells. Though seldom seen on shore, they are frequently brought up on the lines by fishermen, to whom they are known by the name of "Dead-men's Fingers." When the polyps are extended, the creature is pleasing and graceful, but very unsightly in the contracted slimy condition in which the sea-faring people find it. It is a mass of cartilaginous matter, holding some portion of lime in its substance. The polyps are increased entirely by budding.

MADREPORIANS.

One species only of this order is found in the cold waters of the North. The ASTRANGIA (A. danæ) is a proper Coral form, regarded with much interest, and was quite unknown until recently, when specimens were found on the shores of Long Island and in Vineyard Sound. On the surfaces of angular broken fragments of rock, this little Coral may be found. It is a very flat and delicate form, and somewhat resembles the small Astreas of warmer waters. It buds from the base and spreads out, but does not increase in thickness. It is not a Reef-building Coral like those of Florida and other warm regions; the diameter seldom exceeding two to three inches. The tentacles show plainly the warty depositaries of the powerful stinging apparatus common to all of this class.

ACTINOIDS—(*Sea-anemones*).

This order includes the large number of interesting forms which, when fully expanded, so much resemble flowers of the garden, that they have been called *Ocean-flowers*. When closed or contracted they present a most uninviting appearance, which is usually the case when an acquaintance is sought. Like creatures of a higher sensibility, however, they are susceptible to kindly treatment, and gradually become familiar, unfolding their beauties fearlessly in the aquarium. The ACTINIA (Metridium marginatum) is the most common species of the order on our coast, and is very abundant in some localities, though its haunts are often overlooked. The obscure crevices in the broken rocks situated between tides, are the favorite places.

On the Florida Reef there are forms of this order which have lime cells, and are Corals. The BRAIN CORALS (Meandrinas) exhibit a number of beautiful shapes, ranging from pretty hemispheres to indefinite masses; these form an important element, with the Astreas, in the great work of Reef-building. The islands (called *keys*, or *cays*, from the Spanish *cayo*, an islet) are made up entirely from the work of the *Polyps* and allied forms. The whole peninsula of Florida, according to Agassiz, is so formed. The fact has been demonstrated that the curious hummocks which are found in all parts of the State are known to be old Coral Reef; this is seen in regular rows, interrupted uniformly by an intervening wet place, called an *everglade*.

The process of Reef-building is an interesting one. We will suppose that the sea-bottom is first visited by a single egg from the Astrea, a small delicate speck of jelly. In a few days this has begun to show a few tentacles, and is apparently, if we should examine it, nothing more than a Sea-anemone; but, in a few weeks, while the little *Polyp* has been establishing itself, it has also been secreting a little lime at the bottom of its tube, and fastened itself thereby to the object that it may have fallen on—perhaps a Clam-shell. Now there will soon be seen a growth of lime upon the edges and sides of the *Polyp*; it loses its likeness to a Sea-anemone, and is covered by a white, jagged coating of lime. Soon another one is growing out alongside of the first, and the animal is also capable of sending forth eggs as well. The single Astrea has now become two, by the process of growth much like that of the branching of vegetables, and this goes on indefinitely. While some species seem, after a time, to attain a definite form, and there remain, the Astreas are indefinite in form, and are thus a valuable element in this great work of building a continent. Besides the actual bulk which the stony Astreas add to the work, there are many other forms which are brought in incidentally, and somewhat dependent on the first. When the bottom has become covered by the Coral rock, there are numerous causes to produce a decay of the *Polyps*. When these are dead, the pores of the Coral are filled up by sand, which adds a little to the height; other Corals grow upon this, and the natural *débris*, which is always swaying about by the tide, is deposited here as well as elsewhere; then there are branching Corals, which take root here, and Gorgonias or Sea-fans and feathers. All these are eaten and crushed down by a variety of great Worms and Fishes. The *débris* from these causes adds another important element. The great Worms (Aphroditaceans) take in and digest the softer parts, and that portion of

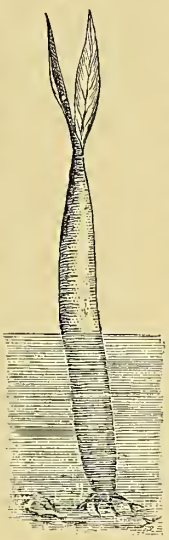
the branch Corals which has been left denuded of flesh dies, and is easily broken by the waves. The Coral-eating Fishes crush the delicate branches, and great quantities are thus thrown down to add to the general mass. In this way the bottom of the ocean has received an additional quantity of material, and the distance between that and the surface is constantly lessened. The ratio is rapidly increased as it goes on, for there are new elements introduced at every turn. The smaller species of Corals—those that require protection—are ready to take root, as it were, and are seen sprouting out in all directions; these also add by their bulk to the general amount. Shell-fish of various kinds take up their abode here, as well as the Hermit and other species of Crabs, together with Worms innumerable; the softer and particularly the dead Corals are found riddled by the latter. The Date-clam is a common source of destruction to the blocks. If we break open a block of dead Coral, it will be found nearly occupied by Worms, boring Shell-fish and Echinoderms. These tend to break up the great masses that eventually spread out to make up the general quota, which, as it gradually reaches the surface, meets other elements entering into its growth. There are many kinds of Coral which are so delicate that they will not grow unless protected from the rude rush of waters, and these are seen to take place in the shallow lagoons or bays which are formed when the Reef has grown up to near the surface of water; when within a few inches or feet, the Algæ and the Corallines are added. All these help in the great work, as every particle of refuse matter from them is so much more towards the aggregate. When the Reef has nearly reached the surface, the water is too shallow for the Corals to flourish in; some other element, then, is requisite for securely holding the top dressing or first dry layers of the new island. Here Nature would seem to have provided means of a wonderful character to

Fig. xii.

Mangrove Trees, Elongated Buds and Young Trees.

meet the situation. The Mangrove-tree (fig. xii) is adapted to this work of finishing the Reef. This is a small shrub-like tree, furnished with a peculiar bud or fruit (fig. xiii), which is capable of elongation so as to touch the Reef. This bud is germinated prematurely in the flower, and the fruit grows to the size and shape of a cigar; indeed, they so closely resemble a cheroot that strangers are frequently deceived when they see them floating in the sea. The buds are cast off in large numbers by the trees, and the latter being always near the water or overhanging it, the former float in the sea. Now, when the buds reach the shallow water covering the Reef, which we have seen growing gradually up by additions of dead and living Corals, the larger end of the bud, being heaviest, is stranded in the sand or mud, and sends out shoots which prove to be little roots. During the still, warm weather of midsummer, these little trees in miniature take root and become fast in the soft mud, and soon grow to be trees. A few leaves shoot forth, and the rootlets at the lower end soon throw out more branches, which serve as braces, so that when the winds of winter come there is little danger of their being disturbed. Myriads of these Mangrove shoots are in this way propagated. The great swamps of the everglades are thus having a constant addition to their boundaries.

Fig. xiii.



Mangrove Bud taking root.

The Mangroves being once established, and the outlying shoots put forth, there is a steady accumulation of floating weeds and the natural waste of the sea. This material is entangled, and gives opportunity for the same to gather around the roots, and, with the aid of all the elements introduced, the surface of the sea is soon reached. The influence of the tide and winds alters somewhat the face of the surface, but the accumulation is sure to produce a firm base, on which the seeds of plants take root. Nature furnishes suitable plants for the purpose. On the Keys a large species of Convolvulus is found, throwing out long and tough runners which take root at certain intervals, and thereby afford a resting-place for the drifting sands; while other and more delicate plants find a footing. We have now a Reef made upon a solid stone basis, and a soil fitted to receive certain plants which serve to augment the chances of a more varied growth. On some of the older Keys there are trees eighty feet in height, and a large variety of smaller kinds. These older islands have in many cases a thickness of soil equal to several feet, entirely made up by the continual growth and decay of vegetable and animal forms.

Professor Agassiz considered that the growth of Coral Reefs only reached a fraction of an inch in a number of years. This estimate of the rate was incorrect, we think, from our observation of the growth of the Madrepores, which during a single winter was seven or eight inches above the lowest tide. When the low tides have exposed the living Corals, there

is certain death to so much as remains out of water. Incrusting specimens upon the walls of Fort Jefferson had been growing probably ten years, and Oculinas were found on the wooden piers at Fort Taylor on Key West. Many of these Corals were six inches in diameter, and as much in height. Taking into consideration the amount of *débris* that naturally accumulates from the remains of the numerous animal forms on the Reef, and the immense quantity of Coral of all species, there is little cause for placing the growth at so slow a rate. A specimen of the Meandrina convexa was found on a half brick, measuring just an inch in diameter. This was placed in an aquarium which was so connected with the sea as to take in fresh water constantly; in one year this Meandrina had increased to two inches in diameter, thus proving the growth in a given time. This specimen was submitted to Prof. Agassiz, who considered it as valuable, in so far as it determined the matter of growth, but it conflicted materially with his theory. Some time after this, Dr. Wienland of Boston, made some observations in the West Indies, which fully confirmed our experience in Tortugas with the specimen before mentioned. He noticed that the branching Madrepores grew to a certain height during the winter, and that when the low tides of summer came, the tops were exposed some seven inches, showing that they had grown so much during the year. These exposed parts being, as already explained, dead, we have thus a large amount of the Madrepores spreading over acres of Reef, the tops bleaching and crumbling.

Along the borders of the deep channels that meander through the Reef are vast masses of Madrepores, branching kinds, of the familiar pattern seen in shops, and called Shrub or Tree-coral. Much of this Coral is six feet in height, with branches two inches in diameter. In the quiet lagoons, or shallow pools, the Porites and Manicinas are abundant; the latter, being so much like a kidney in shape and size, bear the name "Kidney-coral." Manicina is a Meandrine form, belonging to the group of Brain-corals, but having a definite characteristic shape and size, never exceeding about four inches in greatest length. The Brain-corals are often very large, but seem to tend mostly to the hemispherical form. The germ or young Coral is first attached to some extraneous object, but when the block has attained a considerable size, the base is seen to be loosely set in the sand or mud, as any foreign boulder. There is exquisite beauty in the small spheres of Meandrina; some of the Astreas, also, are of the same shape, and present, when denuded of flesh, a marvellous richness of form in the crape-like cells.

The Sea-feathers of the Florida Reef are especially attractive. In the shallow waters many acres of these forms are seen, varying much in color, and presenting a most pleasing view. *Polyps.*—Plate 2, fig. 14, exhibits the polyps of a Plumularia or Sea-feather, both closed and expanded. At the bases of these forms, growing among the Algæ and Corallines, are great numbers of Zoanths, having pretty star-shaped, flower-like heads. Fig. 12 is a representation of one of the same genus; the upper surface of the tentacles is of a rich emerald-green color. Figs. 6 and 7 are polyps of the Caryophyllia, named from its resemblance to a clove. Specimens of this genus are sparsely dredged in the channels near Fort Jefferson. Fig. 8 is an Oculina, species of which are found incrusting the piers or large blocks of Astreas. Figs. 4 and 5 are those of a most common kind—the Astrea, with the polyps closed. On Plate 1, fig. 6, is shown a portion of the precious Red-coral; and fig. 9 is that of a Gorgonia, showing the close relationship between them. The black stalks of the latter, denuded of their lime coating and fleshy parts, are quite like jet, and are nearly as rich for jewelry as those of the red form of the Mediterranean.

The Corals of America are mostly found in the West Indies, the regions around Central America, and the peninsula of Florida. They correspond very closely, and many species are identical in each place. Gorgonias are exceedingly abundant on the Florida Reef.

SEA-FAN (*Gorgonia flabellum*).—This is the Sea-fan of the dealers, a beautiful object, particularly in the sea, when its colors are fresh, and an iridescence plays upon it. Gorgonias are soft Corals, the lime portion being only held in a loose condition around a solid black base; this base is a substance much of the consistence and quite of the chemical constituents of animal horn. The stalk grows upon some rock or other solid object on the bottom, and the Gorgonia attains the form of a shrub. The branches are covered with small pores, from which the polyps emerge, as in the stone Corals, though in many they are exceedingly minute.

PROTOZOA AND PORIFERA.

Interesting accounts of these minute animals are in vol. ii of this work, and the Plates of *Infusoria Rotatoria* and *Rhizopoda* present figures of prominent individuals. The volumes published by the Fish Commission contain a good deal of new matter relating to these forms. Some pretty Sponges are found growing on the piers at Portland, Me., and in Beverly Harbor, Mass., and several kinds are thrown upon our beaches during storms.

INDEX TO AMERICAN FAUNA.

*** *The figures used in this Index refer to the Roman numeral characters employed in the pagination of the text.*

Page.

Acalephæ . . . 277
Acanthurus . . . 236
Acari, Red . . . 19
" White . . . 19
Achirus 228
Acipenser . . . 250
Acris 221
Actinoids . . . 280
Actiturus . . . 188
Adder, Water . . 219
Ægialitis . . 183, 184
Ægiothus . . . 143
Ælurichthys . . . 249
Æstrelata . . . 209
Agaphelus . . . 126
Agclaius 148
Agkistrodon . . . 218
Agonus 234
Agouarachy . . . 59
Agouti 105
Ai 109
Aix 198
Alauda 147
Alhatross, Black-footed . 209
" Short-tailed . 208
" Sooty . . 209
Albula 247
Alca 210
Alce 117
Alco 69
Alligator 220
Alopias 254
Alosa 248
Alutera 227
Amblystoma . . . 222
Ammocœtes . . . 255
Ammodromus . . 144
Ammodytes . . . 243
Ampelis 141
Amphishæna . . 221
Amphiuma . . . 222
Amphiura . . . 277
Amyda 215
Anarrhichus . . . 232
Anas 196
Anchovy . . . 249
Angel-fish . . 236, 252
Angler 226
Anguilla 250
Anhinga 203
Ani 160
Anolius 217
Anous 208
Anser . . 195, 196
Ant-eater, Great . . 111
" Little . . 111
Antelope, Prong-horn . 121
Anthus 138
Antilocapra . . . 121
Ant-lion 273
Antrostomus . . 156, 157
Antrozous . . . 27
Ants 271
" White . . . 273
Anura 221
Apella 15
Apeltes 228
Aplocerus . . . 121

Page.

Aptenodytes . . . 210
Aquila 174
Araguato . . . 10
Aramus 193
Archihuteo . . . 174
Architeuthis . . . 264
Archosargus . . . 241
Arctocephalus . . 76
Arctomys . . . 90
Arctophoca . . . 79
Ardea 191
Ardetta 191
Argonaut . . . 265
Argyreiose, Hair-finued 238
Argyriosus . . . 238
Argyrotænia . . . 243
Ariopsis 250
Aromochelys . . . 215
Arvicola . . . 96, 97
Aspidonectes . . . 215
Aspidophore . . . 234
Aspidophoroides . . 234
Asteroids . . . 276
Astracauthiou . . 276
Astrophyton . . . 277
Astroscopus . . . 233
Astur 172
Ateles . . . 11–13
Atthis 160
Auchenia . . . 116
Auk, Aleutian . . . 211
" Crested . . . 211
" Great . . . 210
" Horn-billed . . 211
" Least . . . 211
" Parroquet . . 211
" Razor-hilled . . 210
" Whiskered . . 211
Aurelia 278
Auriparus . . . 137
Avocet 185

Badger, American . 36
" Mexican . . 36
Bairdiella . . . 241
Balæna . . . 124, 125
Balænoptera . . . 129
Balistes 227
Barracuda, Northern . 244
Bascauiou . . . 219
Basket-fish . . . 277
Bass 241
" Red 241
" Sea 241
" " Black . . 242
" Striped . . . 242
Bassaris 50
Bat, Big-eared . . 27
" Blunt-nosed . . 26
" Brown . . . 25
" " Little . . 26
" California . 24, 27
" Carolina . . 25
" D'Orhiguy's . . 28
" Georgiau . . 25
" Gila . . . 27
" Hoary . . . 25
" Pale . . . 27

Page.

Bat, Red . . . 24
" Silvery-haired . 26
" Western . . 26
Bat-fish 225
Batrachia . . . 221
Batrachus . . . 233
Bear, Black . . . 40
" Cinnamon . . 40
" Northern Sea . 74
" Polar . . . 41
" Spectacled . . 41
Beaver 91
Bee 270
Beetles 273
Bellows-fish . . . 223
Belone 245
Beluga 131
Big-eye, Common . . 243
" Short . . 243
Bill-fish 236
Bimana 1–8
Bisou, American . . 120
Bittern, American . . 191
" Least . . 191
Bivalves 269
Blackbird, Brewer's . 151
Cow 147
Crow 150
Red-shouldered . 148
Red-wiuged . . 148
Rusty . . . 150
Savaunah . . 160
Yellow-headed . 148
Blarina . . . 31, 32
" Mole-like . . 31
Blennus 233
Bleuny, Sea-weed . . 233
Blepharichthys . . 238
Blue-bird . . . 136
California . . 136
Rocky Mountain . 136
Blue-fish . . . 243
Boboliuk . . . 147
Boh-white . . . 182
Bolina 277
Bonassa 181
Bonito 237
Botaurus . . . 191
Box-fish 227
" Hairy . . 227
" Spring . . 227
Brachiopoda . . . 269
Brachyrhamphus . . 211
Brachyteles . . . 13
Bradypus . . . 109
Branchiostoma . . 256
Brant 196
Branta 196
Bream 241
Brosmius . . . 231
Bubo 167
Bucephala . . . 199
Budytes 138
Buffle-head . . . 200
Bugs 273
Buuting, Baird's . . 144
" Bay-winged . 144
" Black-throated 145

Page.

Bunting, Green-tailed . 147
" Lark . . 145
" Painted . . 146
" Seaside . . 144
" Snow . . 143
" Townsend's . 146
" Varied . . 146
" Yellow-winged 144
Buriou 143
Burmeisteria . . . 111
Buteo 173
Butter-fish, Banded . 232
" Common . 232
Butterflies . . . 272
Buzzard, Harris' . . 173
" Turkey . . 177
Bythites 231

Cacajao 19
Calamospiza . . . 145
Calidris 187
Callipepla . . . 183
Callithrix . . . 16
Callocephalus . . . 68
Callorhinus . . . 74
Calypte 159
Campanella . . . 278
Campephilus . . . 161
Camptolæmus . . 200
Campylorhynchus . . 138
Canace 179
Canidæ . . . 55–60
Canis . . . 54, 55
Capparo 14
Capra 122
Capuchin, Brown . . 14
Capybara . . . 104
Carangus . . . 238
Cardinal 146
" Texas . . 146
Cardinalis . . . 146
Carihou, Barren Ground 118
" Woodland . 117
Caruivora . . 34–65
Carpodacus . . . 143
Casabe 238
Castor 91–94
Cat, Black . . . 42
" Pampas . . . 64
" Red . . . 65
" Tiger . . . 63
" Wild, American . 64
" " Texas . . 64
Cat-hird 134
Cat-fish, Fork-tailed . 249
" Sea . . . 250
Caterpillars . . . 272
Catharista . . . 176
Catherpes . . . 138
Catodon, Great-headed . 130
" Kreeft's . 130
Caudina 276
Cavia 104
Cavy, Patagonian . . 104
Cebuella 20
Cebus . . . 14–15
" Capped . . 15
" Monk . . . 15

	Page.
Cebus, Pale	15
" Slender	15
" Thick-furred	15
" Tufted	15
" White-cheeked	15
" White-fronted	15
" White-headed	15
" White-throated	15
Cedar-bird	142
Celuta	229
Centipede	275
Centrocercus	189
Centropristis	242
Centurus	163
Cephalopods	264
Cephaloptera	251
Ceratacanthus	227
Ceratoptera	251
Ceratorhina	211
Cercolabes	105
Cercoleptes	36
Certhia	138
Cervus	118, 119
Ceryle	156
Cetacea	123–131
Cetorhinus	253
Ceutronyx	144
Chacalacca, Texas	179
Chætura	158
Chamæpelia	178
Chamea	137
Chameck	11
Chameleon	217
Charadrius	183
Chat, Stone	136
" Yellow-breasted	140
Chati	64
Chaulelasmus	197
Cheiroptera	22–28
Chelonia	215, 216
Chelopus	214
Chelydra	215
Chibiguazu	64
Chickadee, Long-tailed	137
Chickaree	84
" Western	84
Chicken, Prairie	181
Chilichthys	227
Chilomycterus	227
Chincha	104
Chinchilla	104
Chipmuck, Harris'	88
" Northern	87
" Say's	88
Chiropotes	18
Chirostoma	245
Chiroteuthis	266
Chlamydophorus	111
Chloroscombrus	238
Chlorosoma	220
Chænopsetta	229
Chogset	235
Cholœpus	109
Chondestes	144
Chordeiles	157
Chorophilus	221
Chrysemys	214
Chrysocyon	58
Chrysothrix	16
Chuck-will's-widow	156
Chuss	231
Chuva	13
Ciliata	231
Ciuclus	135
Cinosternum	215
Circe	278
Circus	172
Cistothorus	138
Cistudo	214
Civet, American	50
Clam, Great	269
Clams	269
Clupea	249
Clytia	279
Cnemidophorus	217
Coachman	242
Coati-moudi, Brown	36
Cock, Chaparral	169
" Sage	180
Coccygus	160
Cod, Tom	231
Cod-fish	230
Codling	231
" Spotted	231
Cœlogenys	105
Coendou	105
Colaptes	164
Collyrio	142
Colpeo	59
Columba	177
Colymbus	209, 210
Comatula	277
Comb-bearers	277
Conchifera	269
Condor, California	176
Condylura	34
Conepatus	49
Conger	250
Conner	235
Contopus	155
Conurus	165
Coon, California	37
Coot, Americau	194
" Sea	201
Copperhead	218
Corals	280
CORMORANT:	
Brandt's	204
Commou	204
Double-crested	204
Mexican	204
Pallas'	204
Tufted	204
Violet-green	204
Corvus	151
Coryphæna	239
Cottus	234
Coturniclus	144
Courlan	193
Cow-bird	147
Coypu	105
Crab, Edible, Americau	275
" Fiddler	275
" Hermit	275
" Horse-shoe	275
Crab-eater	243
Crane, Sand-hill	192
" Whooping	192
Creeper, Bahama	142
" Brown	138
Crevallé, Horse	238
" Yellow	238
Cribrella	276
Cricetodipus	99
Crinoids	277
Crocodile, American	220
Crocodilia	220
Crocodilus	220
Crossbill, Red	143
" White-wiuged	143
Crotalophorus	218
Crotalus	218
Crotophaga	160
Crow, Carrion	176
" Clark's	152
" Common	151
" Fish	152
" " Northwestern	152
" Florida	152
" White-necked	151
Crustacea	275
Crying-bird	193
Cryptacanthodes	232
Ctenodiscus	277
Ctenomys, Brazilian	105
Ctenophoræ	277
Cuckoo, Black-billed	160
" Mangrove	160
" Yellow-billed	160
Cuniculus	97
Cupidonia	181
Curlew, Esquimaux	189
" Hudsonian	189
" Long-billed	189
Curvirostra	143
Cusk, European	231
" Little	232
" " New York	231
Cuttle, Giant	264
Cuvieria	276
Cuvierius	128
Cuxio	18
" Black	18
" Brown	18
" White-nosed	18
Cyanea	278
Cyanocetta	153
Cyanospiza	146
Cyanura	153
Cyclopterus	233
Cyclothurus	111
Cygnus	195
Cymbium	238
Cymochorea	209
Cynomys	89
Cynoscion	240
Cyrtonix	183
Cystophora	72
Dab, American	229
" Long	229
" Rusty	229
Dab-chick	210
Dactylopterus	233
Dafila	196
Daption	209
Dasyprocta	105
Dasypus	110
Decapoda	266
Decapterus	238
Deer, Black-tailed	119
" Mule	119
" Red, American	118
" Sonora	119
" South American	119
" White-tailed	119
Delphinus	130
Deudroica	139
Desmodus	28
Desmoguathus	22
Devil-fish	251
" Greater	264
Diacria	266
Diadophis	220
Dicotyles	115
Didelphis	132
Diemyctylus	222
Diomedia	208, 209
Diplectrum	242
Dipodomys	99
Dipper	200
" American	135
Discophoræ	277
Diver, Black-throated	209
" Great Northern	209
" Red-throated	210
Dog-fish, Picked	255
Dolichonyx	147
Dolichotis	104
Dolphiu, Common	130
" Leseur's	239
" Small-spotted	239
Dorosoma	249
Douroucouli	17
Dove, Carolina	178
" Ground	178
" Red-billed	177
" Scaly	178
" Sea	211
Dove, White-winged	178
" Zenaida	178
Drum, Banded	241
" Big	240
Duck, Black	196
" Buffle-head	200
" Canvas-back	199
" Dipper	200
" Eider	201
" " King	201
" Golden-eye	199
" " Barrow's	200
" Harlequin	200
" Hooded Merganser	202
" Labrador	200
" Long-tailed	200
" Mallard	196
" Old-wife	200
" Red-head	198
" Ring-neck	198
" Ruddy	202
" Scaup, Greater	198
" " Lesser	198
" Spectacled	201
" Steller's	201
" Summer	198
" Surf	201
" Velvet	201
" " Scoter	201
" Wood	198
Dules	242
Dunlin, American	187
Dypodomys	99
Dysmorphosa	279
Eagle, Bald	175
" Caracara	170
" Golden	174
" Sea, Gray	175
Echeneis	244
Echiuarachnius	276
Echinodermata	276
Echinoids	276
Echimys	105
Ectopistes	177
Edeutata	108–112
Eel, Common	250
" Conger	232, 250
" Sand	243
Egret, Louisiana	190
" Reddish	190
" White, Great	190
" " Little	190
Elacate	243
Elanus	171
Elaps	218
Elasmognathus	115
Elops	247
Embernagra	145
Emerald, Linnæus'	160
Empidonax	155
Emys	214
Engraulus	249
Enhydra	47
Eolis	267
Ephippus	242
Epinephelus	242
Eremophila	147
Erethizon	100
Ereunetes	186
Erismatura	202
Ermine, Kane's	44
Eschrichtius	127
Etrumeus	247
Eubalæna	126
Eucope	278
Eudromias	184
Eugomphodus	254
Eulamia	254
Eumeces	217
Enmesogrammus	232
Eumetopias	77
Euphractus	110

	Page.
Euspiza	145
Eutainia	218
Evotomys	96
Exocœtus	245
Falco	169, 170
Falcon, Aplomado	170
Peregrine, American	169
Prairie	169
White	169
Farancia	220
Felis	70–74
Ferret, Black-footed	45
Fiber	98
File-fish, European	227
" Long-tailed	227
" Orange	227
" Powel's	227
" Storer's	227
Finch, Arkansas	143
" Bell's	144
" Canon	147
" Grass	144
" Gray-crowned	143
" House	143
" Lazuli	146
" Purple	143
" Sharp-tailed	144
" Thick-billed	145
Fisher	42
Fishes	223–260
Fishes, Fresh-water:	
Bass	257
Bow Fins	260
Carp-like Fishes	259
Cat-fishes	260
Cave-fishes	258
Cod	258
Darters	256
Eels	260
Gar Pikes	260
Gobies	258
Herring	259
Lampreys	260
Maigres	257
Mud Minnows	258
Perches	257
" Pirate	257
" Trout	258
Pickerel	258
Pike, Great	258
Sculpins	258
Shiner, Common	259
Silversides	258
Sticklebacks	258
Sturgeons	260
Suckers	259
Sun-fish	257
Trout	258
Flamingo, American	195
Flasher	243
Flat-fish, Putnam's	229
Flicker	164
" Cape	165
" Hybrid	165
Flies, Bot	273
" Gall	271, 273
" Horse	273
" Sand	271
Flounder, Common	229
" Four-spotted	229
" Summer	229
Fly, Common House	273
" Forest	273
" Hessian	273
Fly-catcher, Arkansas	155
Ash-throated	155
Black	155
Blue-gray	137
Canada	141
Cassin's	155
Couch's	155
Fork-tailed	154
Fly-catcher:	
Great-crested	155
Green black-cap	140
Green-crested, small	155
Hammond's	156
Least	155
" Buff-breasted	156
Little	155
Mexican	155
Olive-sided	155
Red	156
Shining-crested	142
Small-headed	140
Swallow-tailed	154
Traill's	155
Wright's	156
Yellow-bellied	155
Flying-fish	245
Fossil Extinct:	
Birds	211, 212
Cheiroptera	22, 23
Dogs and Cats	51–53
Edentata	108, 109
Fishes	225
Insectivora	29, 33
Melinæ	48
Mustelidæ	41
Pinnipedia	67
Rodents	81, 82
Ungulates	112–114
Ursidæ	39
Fox, American	56
" Antarctic	59
" Arctic	57
" Black	56
" Coast	57
" Crab-eating	59
" Cross	56
" Gray	57
" Kit	57
" Prairie	57
" Short-tailed	57
" Silver	56
" Slender	59
" Swift	57
" Yellow-legged	60
Fratercula	210, 211
Fregetta	209
Frigate-bird	203
Frog, Bull	221
" Common	221
" Cricket	221
" Green	221
" Pickerel	221
" Tree	221
" Wood	221
Frog-fish, Tufted	226
Fulica	194
Fuligula	198, 199
Fulmar	209
" Giant	209
" Slender-billed	209
Fulmarus	209
Fundulus	245
Gadus	230
Gadwall	197
Galeocerdo	254
Galera	49, 50
Galictis	49
Gall-flies	271, 273
Gallinago	186
Gallinula	194
Gallinule, Florida	194
Gannet, Common	202
Gar, Silver	245
Gasteropoda	267
Gasterosteus	228
Gelasimus	275
Geococcyx	160
Geomys	99
Georgia	219
Geothlypis	140
Gerfalcon, White	169
Ghost-fish	232
Gilt-head	241
Glaucidium	168
Globe-fish	226
Glyptocephalus	229
Goat, Mountain	121
Gobiosoma	233
Goby, Black	233
" Scaleless	233
" Striped-sleeper	233
Godwit, Black-tailed	187
" Great Marbled	187
Goldfinch, Black	143
" Pine	143
" Mexican	143
Goose, Blue	196
" Canada	196
" Ross's	196
" Snow	195
" White-fronted	195
Gopher, Mexican	99
Pocket, Central Am.	99
" Common	99
" Chestnut	99
" Florida	99
" Northern	100
" Pacific	100
" Rocky M'nt'n	100
" Southern	100
Gorgonia	282
Goshawk, American	172
Graculus	204
Grakle, Boat-tailed	151
" Bronzed	151
" Florida	151
" Great-tailed	151
Grasshopper	273
Grebe, Crested	210
" Eared	210
" Horned	210
" Pied-bill	210
" Red-necked	210
" St. Domingo	210
" Western	210
Greenlet, Florida	141
" Philadelphia	141
" Red-eyed	141
" Warbling	141
Grison	49
Grosbeak, Black-headed	146
" Blue	146
" Evening	143
" Pine	143
" Rose-breasted	146
Grouper, Red	242
Grouse, Dusky	180
" Franklin's	180
" Ruffed	181
" Sharp-tailed	180
" Willow	181
Grunts	241
Grus	192
Guanaco	116
Guillemot, Black	211
Black-throated	211
Marbled	211
Pigeon	211
Sooty	211
Temminck's	211
Thick-billed	211
Guinea-pig	104
Guiraca	146
Gull, American Mew	206
Bonaparte's	206
Burgomaster	205
Californian	205
Forked-tail	207
Franklin's Rosy	206
Glaucous-winged	205
Great Black-backed	205
Heerman's White-headed	206
Gull, Herring	205
Ivory	206
Kittiwake, Common	206
" Red-legged	206
Laughing	206
Ring-billed	205
Swallow-tailed	207
Wedge-tail	207
White-winged	205
Gulo	35
Gulper	250
Gunnel, Big-headed	232
Gymnokitta	152
Gyrinophilus	222
Habrocome, Bennet's	105
Haddock,	231
" Norway	234
Hæmatopus	185
Hæmulon	241
Hair-tail, Silvery	237
Hake, European	231
" Squirrel	231
Halcyonoids	280
Haldea	220
Haliaëtus	175
Halibut	229
Halichœrus	70
Halocyptina	209
Halyclistus	278
Hapale	19
" Pigmy	20
Haplodon	90
Hare, Brazilian	102
" Californian	103
" Central American	102
" Grayson's	102
" Marsh	103
" Mexican	103
" Northern Varying	102
" Polar	101
" Prairie	101
" Trowbridge's	102
" Water	103
" Wood	102
Harelda	200
Harporhynchus	135
Harvest-fish	239
Hawk, Baird's	173
" Band-tailed	173
" Broad-winged	173
" Cooper's	172
" " Red-tail	174
" Duck	169
" Fish	170
" Gruber's	173
" Harlan's	174
" Marsh	172
" Night	157
" " Texas	157
" " Western	157
" Pigeon	169
" Red-shouldered	173
" Red-tailed	173
" Rough-legged	174
" Sharp-shinned	172
" Sparrow, American	170
" " California	174
" Swainson's	173
Hedymeles	146
Heliopædica	160
Helix	268
Hellbender	222
Helminthophaga	138
Helmitherus	138
Hemantolophus	226
Hemidactylium	222
Hemitripterus	234
Heron, Blue, Great	190
" " Little	190
" Florida	190
" Green	190
" Louisiana Egret	190

Heron, Night, American 190
" Reddish Egret 191
" Snowy 190
" White 190
" White, Great 190
" Yellow-crowned 191
Herring 248
" Big-eyed 247
" English 249
" Round 247
" Tailor 248
" Thread 248
" Toothed 249
Hesperiphona 143
Hesperomys 94
Heterodon 219
Heterofuscus 267
Heteroscelus 189
Himantopus 185
Hippasteria 276
Hippocampus 227
Hippoglossus 229
Hirundo 141
Histiophorns 236
Histrionicus 200
Hog-fish 227, 256
Holacanthus 236
Holocentrum 240
Holothurians 276
Homarus 275
Horn-tails 271
Horse-fish 238
Hound-fish, Smooth 254
Howler, Black 10
" Black and Yellow 10
" Brown 10
" Gray-handed 10
" Mantled 10
" Red and Yellow 10
" Silky 10
" Ursine 10
" Villous 10
" Yellow-handed 10
HUMMING-BIRD, Anna 159
Black-chinned 159
Broad-tailed 159
Calliope 158
Costa's 159
Emerald, Linnæus' 160
Heloisa's 160
Ruby-throated 159
Rufous-backed 159
Zantus' 160
Hummer, Ruffed 159
Hyhoeodon 279
Hydraetinia 279
Hydroehœrus 104
Hydrochelidon 208
Hydroids 278
Hyla 221
Hylatomus 162
Hystrix 100

Ibis, Glossy 190
" Wood 189
Icteria 140
Icterus 148, 149
Ictinia 171
Idyia 277
Indigo-bird 146
Insectivora 29–34
Insects, Arachnida 273
" Coleoptera 273
" Diptera 273
" Hemiptera 273
" Hexopoda 270
" Hymenoptera 270
" Lepidoptera 272
" Myriapoda 275
" Neuroptera 273
" Orthoptera 273
Invertebrata 261
Isuropis 253

Jacchus 20
Jack 238
Jackdaw 151
Jager, Buffon's 205
" Parasitic 205
" Pomarino 205
" Richardson's 205
Jaguar 62
Jay, Blue 153
" Brown 154
" California 153
" Canada 154
" Florida 153
" Green 154
" Maximilian's 152
" Steller's 153
" Ultramarine 154
" Woodhouse's 153
Jelly-fishes 277
Jew-fish 247
Jumping-mouse 98
Junco 144
" Mexican 144

Kestrel, American 170
Killi-fish 245
King-bird 154
" Gray 155
King-fish 241
King-fisher, Belted 156
Kinkajou 36
Kite, Black-shouldered 171
" Fork-tailed 171
" Hook-billed 171
" Mississippi 171
Kittiwake, Common 206
" Red-legged 206

Labrax 242
Lacertilia 217
Lactophrys 227
Lady-fish 247
Lafayette 241
Lagodon 241
Lagomys 103
Lagopus 181
Lagostomys 104
Lagothrix 13, 14
Lagotis 104
Lamna 253
Lamprcys 255
Lampris 239
Lancelet 256
Lanius 142
Lanivireo 141
Lanner, American 169
Lanus 206
Laomedia 279
Larimus 241
Lark, Meadow 148
" Shore 147
" Western 148
Larus 205
Lasiurns 25
Lemming, Collared 97
Leontopithecus 20
Leptecheneis 244
Leptonyx 71
Leptophis 219
Lepus 101
Leucostiete 143
Limanda 229
Limosa 187
Ling 231
Liostomus 240
Liparis 233
Lizard, Blue-tailed 217
" Green 217
" Ground 217
" Pine-tree 217
" Six-lined 217
Llama 116
Lobipes 185

Lobodon 70
Lobotes 243
Log-cock 162
Loggerhead 216
Loligo 266
Loligopsis 266
Lomvia 211
Loon 209
Lophius 226
Lophophanes 137
Lophopsetta 229
Lophortyx 182
Lucernaria 278
Lump-fish 233
Lupa 275
Lupus 54
Lutjanas 241
Lutra 46, 47
Lycalopex 58
Lycodes, Varl's 232
Lynx, Canada 65

Mackerel 237
" Chub 237
" Horse 237
" Spanish 238
" Yellow 238
Macrobus 24
Macrochelys 215
Macrorhamphus 186
Madreporians 281
Magpie 152
" Yellow-billed 153
Maikel 49
" Patagonian 49
Malaeoclemmys 214
Mallard 196
Malotus 246
Malthe 225
Manatee 132
Marguay 63
Marikina 20
Marimonda 11
Marmoset 20
" Black and Gold 20
" Black-tailed 20
" White-eared 19
Marmot, Hoary 90
" Rocky Mountain 90
Marsh-hen 193
Martin, Purple 141
Masticophis 219
MEADOW MOUSE:
Chestnut-cheeked 97
Common American 96
Oregon 97
Prairie 97
Townsend's 97
Meandrina 280
Megalops 247
Meganeuron 130
Megaptera 127
Melanerpes 163, 164
Melanogrammus 231
Meleagris 179
Melieertum 279
Melopelia 178
Melospiza 145
Menhaden 247
Menopoma 222
Montieirrns 241
Mephitis 48
Merganser, Hooded 202
Mergulus 202
Merlin, American 169
Merlueius 231
Metridium 280
Mico 20
" White and Gold 21
Micoella 21
Microgadus 231
Micropalama 186
Midas 21

Midas, Brown-headed 21
" Crowned 21
" Parti-colored 21
" Red-bellied 21
" Whiskered 21
" White-checked 21
Midge, Mackerel 231
Milvulus 154
Mimus 134
Mink, Common 45
" Little Black 45
Minnow, Banded 245
" Barred 245
Miriki 13
Mitrephorus 156
Mniotilta 138
Mocassin, Water 218
Mocking-bird 134
" Mountain 135
Modela 221
Mola 226
Molaeanthus 226
Mole, Common 33
" Gibbs' 34
" Hairy-tailed 33
" Oregon 33
" Prairie 33
" Silver 33
" Star-nosed 34
Molga 231
Mollusca 262–270
" Brachiopoda 269
" Cephalopods 264
" Conchifera 269
" Gasteropoda 267
" Pteropoda 266
" Pulmonifera 268
" Tunicata 270
Molothrns 147
Monkeys 8–21
" Spider 11–13
Monodon 131
Moon-fish 242
" Silver 238
Moose 117
Morone 242
Morse 72
Morunga 71
Mosquito 273
Motacilla 138
Moths 272
" Geometer 272
" Hawk 272
Monse, Aztec 95
" Black-eyed 95
" Cooper's 97
" Deer 95, 98
" Golden 95
" Harvest, Little 96
" " Long-tail 96
" " Mexican 96
" Jumping 98
" Michigan 95
" Mole, Arizona 95
" " Missouri 95
" Parasitic 95
" Pine 97
" Pocket, Hispid 98
" " Honduras 98
" " Least 99
" " Mountain 98
" " Yellow 99
" Red 95
" Red-backed 96
" Rice-field 95
" Tuft-tailed 98
" Western Prairie 97
" White-footed 95
Mugil 244
Mullet 244
" Rock 244
" Striped 244
Murænoides 232

	Page.
Murre	211
Murrelet, Kittlitz's	211
Muskrat	98
Mussels	269
Mustela	42, 45
Mustelus	254
Mycetes	10
Myiarchus	155
Myiodioctes	140
Myodes	97
Myopotamus	105
Myrmecophaga	111
Myzopsetta	229
Nanemys	214
Nannook	41
Nanomina	279
Narwhal	131
Nasua	36
Nauclerus	171
Naucrates	238
Nautilus	265
Necturus	222
Neobalæna	125
Neocorys	138
Neophoca	77
Neosorex	30
Neotoma	94
Nephœcetes	158
Nerodia	219
Nipper	235
Nisus	172
Numenius	189
Nurse	255
Nuthatch, White-bellied	137
Nyctale	167
Nyctea	167
Nyctiardea	190, 191
Nycticejus	24
Nyctinomus	24
Nyctipithecus	17
Oceana	279
Oceanites	209
Oceanodroma	209
Occlot	63
Ochetodon	96
Octodon	105
" Cumming's	105
Octopoda	265
Octopus, Baird's	265
Œdipus	20, 21
Oidemia	201
Oligosoma	217
Ommastrephes	266
Ommatophoca	71
Opah	239
Ophibolus	219
Ophidia	217–220
Ophidium	231
Ophiopholis	277
Ophisaurus	217
Ophiurians	277
Opisthonema	248
Oporornis	140
Opossum, Virginia	132
Orabassu	16
" Bright	16
Orchetodon	96
Orcynus	237, 238
Oreopeleia	178
Orcortyx	182
Oriole, Audubon's	148
" Baltimore	149
" Black-headed	148
" Bullock's	150
" Hooded	150
" Orchard	149
" Scott's	149
Oroscoptes	135
Ortalida	179
Orthagoriscus	226
Ortyx	182
Osceola	220
Osmerus	246
Osprey, American	170
Ostracion	227
Otaria	73
Otter, California	47
" North American	46
" Sea	47
Otus	165, 166
Ouakaria	19
Ousel, Water	135
Ovibos	122
Owl, Barn, American	165
" Barred	166
" " Western	166
" Burrowing	168
" Feilner's	167
" Gray, Great	166
" Hawk,	168
" Horned, Great	167
" Long-eared	165
" Pigmy, California	168
" Red, Little	167
" Red-tailed	168
" Saw-whet	167
" Short-eared	166
" Snowy	167
" Sparrow	167
" Whitney's	168
Ox, Musk	122
Oyster	269
Oyster-catcher	184
" Bachman's	185
" Black	185
Paca	105
Pagophilus	69
Paisano	160
Palinurichthys	239
Pampas Cat	64
Pandion	170
Panther, American	60
Panyptila	158
Parabuteo	173
Parakeet	165
Paralepis	247
Paratractus	238
Parephippus	242
Parrot, Carolina	165
Partridge	181, 182
" Blue	183
" Massena	183
" Plumed	182
" Scaled	183
" Spruce	179
Parula	139
Parus	137
Passerella	145
Peccary, Collared	115
" White-lipped	115
Pecos	99
Pediocætes	180
Pelecanus	202, 203
Pelican, Brown	203
" White	202
Penguin	210
Pentacta	276
Perch, Silver	241
" White	242
Perisoreus	154
Perissoglossa	139
Perognathus	98
Petrel, Ashy	209
" Black	209
" Black-capped	209
" Fork-tailed	209
" Hornby's	209
" Leach's	209
" Least	209
" Pintado	209
" Stormy	209
" Wedge-tail	209
" White-bellied	209
Petrel, Wilson's	209
Petromyzon	255
Peucæa	145
Pewee, Phœbe	155
" Say's	155
" Short-legged	155
" Wood	155
Phæton	204
Phalarope, Northern	185
" Red	185
" Wilson's	185
Phalaropus	185
Phaleris	211
Philohela	185
Philomachus	188
Phithecia	17
Phoca	70
Phocæna	131
Phocarctos	75
Phœnicopterus	195
Phœnopepla	142
Phrynosoma	217
Phycis	231
Phyllopneusts	136
Physalia	279
Physalus	128
Physeter	130
Pica	152, 153
Picicorvus	152
Picoides	162
Picus	161
Pigeon, Band-tailed	177
" Blue-headed	179
" Capo	209
" Key West	178
" White-headed	177
" Wild	177
Pig-foot	234
Pika, North American	103
Pilot-fish	238
Pimelepterus	241
Pinche	21
Pinicola	143
Pinnipedia	65–79
Pintail	196
Pipe-fish	228
Pipilo	146, 147
Pipit, European	138
Piscus	162
Pithecia	17, 18
Pituophis	219
Plagusia	228
Plaice, Smooth	229
Plectrophanes	143
Plestiodon	217
Plethodon	222
Pleurobrachia	277
Pleuronectes	229
Plotus	203
Plover, Black-bellied	183
" Golden, American	183
" Killdeer	183
" Mountain	184
" Piping	184
" Ring	184
" Ruddy	187
" Upland	188
" Wilson's	184
Pochard, American	198
Podiceps	210
Podilymbus	210
Poescopia	127
Pogonius	240
Polioptila	137
Pollachius	229
Pollock	229
Polyborus	170
Polypi	280
Pomatopsetta	229
Pomatopus	243
Pomolobus	248, 249
Pompano	238
" Glaucous	238
Pompano, Short	238
Poocætes	144
Poospiza	144
Porcupine, Brazilian	105
" Canada	100
Porgee, Three-tailed	242
Porifera	282
Porpoise	131
Portuguese Man-of-War	279
Porzana	194
Prairie-dog	89
" Western	89
Priacanthus	243
Prionodos	110
Prionotus	233, 234
Pristis	252
Procellaria	209
Procyon	37, 38
Progne	141
Promicropterus	242
Pronotus	239
Proteidæ	222
Prothonotary	138
Protozoa	282
Psaltiparus	137
Pseudemys	214, 215
Pseudogryphus	176
Pseudolopex	59
Pseudopleuronectes	229
Pseudopriacanthus	243
Psilorhinus	154
Psittace	165
Psora	37
Psycho	266
Ptarmigan, Rock	181
" White	181
" White-tailed	182
Ptcrophryne	226
Pteropoda	266
Ptychorhamphus	211
Puffer, Rough	227
" Smooth	227
Puffin, Common	210
" Horned	210
" Tufted	211
Puffinus	209
Pulmonifera	268
Puppy, Mud	222
Putorius	228
Pyranga	142
Pyrgita	144
Pyrocephalus	156
Pyrrhuloxia	146
Quachil	99
Quadrumana	7–21
Quail	182
" California	182
" Gambel's	182
Querquedula	197
Quiscalus	150
Rabbit, European	103
Raccoon	37
" Black-footed	37
" California	37
" Crab-eating	38
Racer, Spotted	219
Radiata	275–282
Raia	252
Rail, Carolina	194
" Clapper	194
" Little Black	194
" Little Yellow	194
" Virginia	193
Rallus	193, 194
Rana	221
Rangifer	117
Rat, Cotton	94
" Kangaroo	99
" Ord's Pocket	99
" Wood	94
" " Bushy-tailed	94

	Page
Rat, Wood, Dusky-footed	94
" " Ferruginous	94
Rattlesnake, Diamond	218
" Ground	218
" Northern	218
Raven, American	151
Ray, Bishop	251
" Butterfly	251
" Clear-nosed	252
" Cow-nosed	251
" Shark	252
" Sharp-nosed	251
" Sting	251
Razor-fish	236
Recurvirostra	185
Red-bird	146
" Summer	142
Red-cat	65
Red-poll, Lesser	143
" Mealy	143
Reed-bird	147
Regulus	136, 137
Reindeer	117
Reithrodon	95
Remora, Common	244
" Indian	244
Reniceps	254
Reptiles	213–220
Rhachianectes	126
Rhinostoma	220
Rhodostethia	207
Rhynchops	208
Rhynogryphus	177
Rice-bird	147
Ring-fish	238
Road-runner	160
Robin	133
" Ground	146
" " Arctic	146
" " Oregon	146
Roccus	242
Rockling, Five-bearded	231
Rodentia	79–107
Rossia	265
Rostrhamus	171
Round Robin	238
Rudder-fish, Black	239
Rudolphins	128
Ruff	188
Ruminantia	116–122
Sable, American	42
Saccopharynx	250
Sai	14
Sail-fish	236
Saki, Bearded	18
Salamander, Four-toed	222
" Mole	222
" Purple	222
" Red-backed	222
" Two-striped	222
" Yellow	222
Salmo	246
Salmon	246
Salpinctes	138
Sanderling	187
Sand-lance, Banded	243
SANDPIPER, Baird's	186
Bonaparte's	187
Buff-breasted	189
Least	186
Pectoral	186
Purple	187
Red-breasted	187
Semi-palmated	186
Spotted	188
Stilt	186
Sapajou, Bonnet	15
" Golden-handed	15
" Grizzled	15
Sarda	237
Sargo	241
Sarsia	279

	Page.
Saw-fish	252
Saw-flies	271
Saxicola	136
Sayornis	155
Scad, Big-eyed	238
Scalops	33
Scaphiopus	221
Scardafella	178
Scelopus	217
Schizodon	105
Sciæna	240
Sciænops	241
Scinopterus	84
Sciurus	84–87
Scomber	237
Scomberesox	245
Scopelus	245
Scops	167
Scorpæna	234
Scotiphilus	25
Scotophis	219
Sculpin, Little	234
" Northern	234
" Slender	234
Scup	241
Scymnus	255
Sea-anemones	280
Sea-bat, Box-headed	225
Sea-cucumbers	276
Sea-elephant	71
Sea-fan	282
Sea-horse	227
Sea-leopard	70
" Falso	71
Sea-lion	73
" Northern	78
" Steller's	78
Sea-parrot	210
Sea-raven	234
Sea-robin, Flying	233
" Lined	233
" Small-scaled	234
" Spotted	233
" Web-fingered	233
Sea-snail	233
Sea-urchins	276
Seal, Banded	69
" Bearded	70
" Common	68
" Crab-eating	70
" Fur, Australian	66
" " Cape	76
" " Chilian	79
" " Commerce	76
" " Forster's	76
" " Southern	76
" Gray	70
" Hair, Australian	77
" " Californian	77
" " Cape	77
" " Southern	75
" Harp	69
" Hooded	72
" " West Indian	72
" Peale's	70
" Richard's	70
" Ringed	69
" Ross's Large-eyed	71
" White-cheeked	70
Seals	65–68
Sebastes	234
Seed-eater, Little	146
Seiurus	140
Selasphorus	159
Selene	238
Sciniocebus	21
Sepia	266
Serrana	242
Sertularians	279
Setophaga	141
Sewellel	90
Shad	248
Shark, Atwood's	253

	Page.
Shark, Basking	253
" Blue	254
" Dusky	254
" Fox	254
" Hammer-head	254
" Mackerel	253
" Shovel-head	254
" Shovel-nose	254
" Tiger	254
SHEARWATER:	
Black-tailed	209
Black-vented	209
Cinereous	209
Dark-bodied	209
Dusky	209
Flesh-footed	209
Greater	209
Mank's	209
Sooty	209
Sheep, Big-horn	122
" Mountain	122
Sheep's-head	241
Sheldrake	202
Shoveller	197
Shrew, Asb-colored	32
" Berlander's	32
" Broad-nosed	30
" Carolina	32
" Cooper's	30
" Forster's	30
" Fringe-footed	32
" Harlan's	32
" Hay's	31
" Hayden's	31
" Marsh	32
" Masked	31
" Narrow-headed	32
" Navigator	30
" Richardson's	30
" Short-tailed	31
" Small	32
" Suckley's	30
" Thick-tailed	30
" Thompson's	31
" Vagrant	30
" Weak-footed	32
Shrike, Great Northern	142
" Loggerhead	142
" White-rumped	142
Sialia	136
Sibbaldius	128, 129
Sigmodon	94
Silk-worm	272
Silurus	249
Silvers des	245
Simorhynchus	211
Siren, Great	222
Sitta	137
Skate, Summer	252
Skimmer, Black	208
Skink, Coal	217
" Northern	217
" Red-headed	217
Skipper Bill-fish,	245
Skua	204
Skunk	48
" California	48
" Little Striped	49
" Texas	48
" White-backed	48
Skylark	147
" Missouri	138
Sleeper	255
Sloth, Hoffman's	109
" Three-toed	109
" Two-toed	109
Smelt	246
Snake, Bead	218
" Black	219
" " Alleghany	219
" Brown	220
" " Small	220
" Chain	219

	Page.
Snake, Chain, Kennicott's	219
" Chicken	219
" Coach-whip	219
" Congo, Two-toed	222
" Corn	219
" Fox	219
" Garter, Common	219
" " Fairies'	218
" " Hay's	218
" " Say's	218
" Glass	217
" Green	219
" " Common	220
" Horn	220
" House	219
" Indigo	219
" Milk	219
" Pine	219
" Red	219
" Ribband	218
" Ring-neck	220
" Scarlet	220
" Worm	220
Snapper, Glass-eyed	241
Snipe, American	186
" Red-breasted	186
Snow-bird	144
Soap-fish	242
Solaster	277
Sole, American	228
" Long	228
Solecophagus	150
Solenodon	33
Solidungula	114
Solitaire, Townsend's	142
Somateria	201
Sommosens	255
Sorex	30–32
Spade-foot, Solitary	221
Spalacopus	105
Sparrow, Bachman's	145
" Black-throated	144
" Brown-headed	145
" Cassin's	145
" Chipping	145
" Field	144
" Fox-colored	145
" House	144
" Ipswich	144
" Lark	144
" Savannah	144
" Slate-colored	145
" Song	145
" Swamp	145
" Texas	145
" Townsend's	145
" Tree	144
" White-crowned	144
Sparus	241
Spatula	197
Spelerpes	222
Spermophila	146
SPERMOPHILE:	
Annulated-tailed	89
Fort Yuma	88
Franklin's	89
Kenni ott's	89
Line-tailed	88
Mexican	89
Parry's	88
Richardson's	88
Short-tailed	88
Sonoran	89
Striped	89
Spermophilus	88, 89
Sphargis	216
Spheotyto	168
Sphyræna	244
Sphyrna	254
Sphyropicus	162
SPIDER-MONKEY:	
Bartlett's	12
Black-faced	12

Page.

SPIDER-MONKEY:
Black-handed . . 13
Brilliant . . . 13
Brown . . . 13
Brown-headed . . 12
Chameek . . . 12
Chuva . . . 13
Grizzled . . . 12
Hooded . . . 12
Long-haired . . 13
Marimonda . . 12
Miriki . . . 13
Red-faced . . . 11
White-fronted . . 13
Spiders 273
" Trap-door . 273
Spirula 266
Spizella 144
Squalus 255
Squatarola . . . 183
Squatina . . . 252
Squeteague . . . 240
Squid, Giant . . . 264
Squirrel, Abert's . . 85
" American Flying 84
" Brazilian . 86
" Collie's . . 85
" Fire-bellied . 86
" Fox . . 85
" Gerrard's . 86
" Golden-bellied 86
" Gray . . 84
" " California 85
" Orizaba . . 86
" Peruvian . 87
" Red-bellied . 86
" Striped . . 87
" Varied . . 86
Squirrel-fish . . . 240
Squit 240
Star, Pink . . . 276
Star-fishes . . . 276
Star-gazer, Naked . 233
Starling 151
Starnænas . . . 141
Start, Red . . . 141
Stellula 158
Stenorhynchus . . 70
Stenotomas . . . 241
Stephanolepis . . 227
Stercorarius . . . 205
Sterna . . . 207, 208
Stickleback, Four-spined 228
" Ten-spined 228
Stilt, Black-necked . 185
Storeria 220
Strepsilas . . . 184
Strix 165
Stromateus . . . 239
Sturgeon, Sharp-nosed 250
" Short-nosed 250
Sturnella . . . 148
Sturnus 151
Sula 202
Sun-fish 226
Surgeon-fish . . . 236
" Black . 236
Surnia 168
Swallow, Barn . . 141
" Chimney . 158
" White-bellied 141
Swan, Trumpeter . . 195
" Whistling . . 195
Swift, Black . . . 158
" Chimney, Oregon 158
" White-throated . 158
Swinhoia . . . 129
Sword-fish, Common . 236
Synapta 276
Synaptomys . . . 97
Syngnathus . . . 228
Synodus 246
Synotus 27

Page.
Synthliborhamphus . 211
Syphonophorians . . 279
Syrnium . . . 166

Tachypetes . . . 203
Tamaudua . . . 111
" Yellow . . 111
Tamanoir . . . 111
Tamarin 21
Tamias . . . 87, 88
Tanager, Scarlet . . 142
Tantalus . . . 189
Tapir, Baird's . . 115
" Common American 115
Tapirus 115
Tatouhou . . . 110
Tattler 187
" Solitary . . 188
" Wandering . 189
Tatusia 110
Tautog 234
Tautoga 234
Tautogalabrus . . 235
Taxidea . . . 35, 36
Tayra 49
Teal, Blue-winged . . 197
" Cinnamon-breasted 197
" Green-winged . 197
Tee-tee 16
" Black-fronted . 17
" Black-banded . 17
" Black-headed . 16
" Collared . . 16
" Gray . . . 17
" Masked . . 16
" Red . . . 16
" Red-bellied . 17
" Reed . . . 16
" Short-tailed . 16
" White-chested . 16
Tell-tale 187
" Lesser . . 188
Teredo 269
Teru, Aleutian . . 208
" Arctic . . . 208
" Black . . . 208
" Bridled . . 208
" Caspian . . 207
" Common . . 207
" Elegant . . 207
" Forster's . . 207
" Gull-billed . . 207
" Least . . . 207
" Marsh . . . 207
" Noddy . . . 208
" Pike's . . . 207
" Portland . . 208
" Roseate . . 208
" Royal . . . 207
" Sandwich . . 207
" Sooty . . . 208
" Trudeau's . . 207
Terrapin, Elegant . . 215
" Red-bellied . 214
" Rough . . 215
" Smooth . . 214
" Yellow-bellied 214
Testudinata . . 213–216
Testudo 213
Tetrapturns . . . 236
Tetrodon . . . 227
Thanmatias . . . 160
Thomomys . . 99, 100
Thons 59
Thread-fish . . . 238
Thresher . . . 254
THRUSH, Brown . . 135
California . . 135
Curved-bill . . 135
Dwarf . . . 133
Golden-crowned . 140
Gray-cheeked . . 134
Hermit . . . 133

Page.
THRUSH, Leconte's . 135
Mexican . . . 135
Olive-backed . . 133
Oregon . . . 133
Varied . . . 134
Water, Louisiana . 140
" Small-billed 140
Wilson's . . . 133
Wood . . . 133
Thryothorus . . . 138
Tima 279
Tit, Black-cheeked . 137
" Black-crested . 137
" Ground . . . 137
" Least . . . 137
Titlark 138
TITMOUSE:
Black-cap . . 137
Tufted . . . 137
Western . . . 137
Yellow-headed Bush 137
Toad, American . . 221
" Common Tree . 221
" Horned . . 217
Toad-fish . . 226, 233
Tolypeutes . . . 110
Torpedo 251
Tortoise, Blanding's . 214
" Gopher . . 213
" Leather . . 216
" Muhlenberg's 214
" Speckled . 214
" Wood . . 214
Tortoises, Land . . 213
Totanus . . . 187, 188
Towhee 146
" Abert's . . 147
" Brown . . 147
" Spurred . . 146
Toxitophis . . . 218
Toxopneustis . . . 276
Trachurops . . . 238
Trachynema . . . 278
Trachynotus . . . 238
Tree sertularia . . 279
Trichechus . . . 72
Trichiurus . . . 237
Trichodiodon . . . 227
Trigla . . . 233, 234
Triuga . . . 186, 187
Tringoides . . . 188
Triton, Spotted . . 222
Trochilus . . . 159
Troglodytes . . . 138
Tropic Bird . . . 204
Troupial 148
Trout, Salmon . . 240
" Sea . . . 246
Trumpet-fish, Tobacco . 228
Trunk-fish . . . 227
Trygon 251
Trygites . . . 189
Tubularians . . . 279
Tucan 99
Tunicata . . . 270
Tunny, Little . . 239
Turbot, Spotted . . 229
Turdus . . . 133, 134
Turkey, Wild . . 179
Turnstone . . . 184
TURTLE, Box . . 214
Northern Box . 214
Cumberland . . 215
Green . . . 215
Hawk-bill . . 216
Hieroglyphic . . 214
Leathery . . . 215
Loggerhead . . 216
Map 214
" Leseur's . . 214
Mud, Small . . 215
Musk . . . 215
" Little . . 215

Page.
TURTLE, Painted . . 214
Salt-marsh . . 214
Snapper, Mississippi 215
Snapping, Common 215
Soft-shelled " 215
Turtles 213
" Cinosternoid . 215
" Pond . . . 214
" Sea . . . 215
" Snapping . . 215
Tyrannus . . 154, 155

Unau 109
Ungulata . . . 115
Uria 211
Urophyeis . . . 231
Urotrichus . . . 34
Ursus . . . 40, 41
Utamania . . . 210

Vespertilio . . 26, 27
Viper, Blowing . . 219
" Water . . . 218
Vireo 141
" Bell's . . . 141
" Black-capped . 141
" Blue-headed . 141
" Cassin's . . 141
" Hutton's . . 141
" Least . . . 141
" White-eyed . . 141
" Yellow-green . 141
" Yellow-throated . 141
Vireosylvia . . . 141
Viscacha . . . 104
Vitoe 17
" Broad-tailed . . 17
Vomer 238
Vulpes . . . 56, 57
Vulture, Burroughs' . 177

Wading-birds . . 183
Wagtail, White . . 138
" Yellow . . 138
Walrus 72
Wapiti 118
WARBLER:
Alaska Willow . . 136
Audubon's . . 139
Bay-breasted . . 139
Black and White Creeping . . 138
Black and Yellow . 139
Black-poll . . 139
Black-throated Blue 139
" " Gray 139
" " Green 139
Cape May . . 139
Carbonated . . 139
Chestnut-sided . 139
Connecticut . . 140
Golden-winged . 138
Hooded . . . 140
Kirtland's . . 139
Lucy's . . . 139
Mountain, Blue . 139
Nashville . . 139
Olive-headed . . 139
Orange-crowned . 139
Pine-creeping . . 139
Prairie . . . 140
Prothonotary . . 138
Rocky Mountain . 139
Tennessee . . 139
Townsend's . . 139
Yellow . . . 139
Yellow-backed, Blue . 139
Yellow-throated . 139
Yellow-red-poll . 140
Yellow-rump . . 139
Yellow-throated, Gray 139
Yellow-throated, Maryland . . 140

	Page.
Warbler, Western	139
Worm-eating Swamp	138
Wasps	271
" Sand	271
Waxwing, Northern	141
Weasel, Bridled	45
" Brown, Small	44
" Common	44
" Least	43
" Long-tailed	44
" Peruvian	45
" Richardson's	44
" Yellow-cheeked	45
Wenona	220
Whale:	
Finner, Ancient	128
" Antarctic	128
" Brazil	128
" Broad-headed	128
" Duguid's	128
" Knox's	128
" Northern	128
" Patagonian	128
" Schlegel's	129
" Sibbald's	128
" Sulphur-bottom	129
Gray, Californian	126
Greenland	124
Humpback, American	127
" Burmeister's	127
Whale:	
Humpback, Long-handed	127
Humpback, Robust	127
Laland's	127
Mediterranean	125
Nordcaper	125
Pike, Beaked	129
" Chinese	129
Right, Antarctic	125
" Seibold's	126
Scrag	126
White	131
Whip-poor-will	156
" Nuttall's	157
Widgeon, American	197
Wild-cat, American	64
" Texas	64
Willet	187
Wolf, Black	55
" Dusky	55
" Gray	54
" Grayish-yellow	59
" Prairie	55
" Red	58
" Rufous	55
" Veteran	58
" Yellow-tailed	59
Wolf-fish	232
Wolverine	35
Wolves, Fox-tailed	58
Woodchuck	90
Woodcock, American	185
" Black	162
Woodpecker:	
Brown-headed	162
California	164
Cape	162
Downy	161
Gairdner's	162
Gila	163
Hairy	161
Harris'	161
Ivory-billed	161
Ladder-backed	162
Lewis'	163
Narrow-frouted	164
Nuttall's	162
Red-bellied	163
Red-cockaded	162
Red-headed	163
Red-naped	162
Red-shafted	165
Three-toed, Black-backed	162
Three-toed, White-backed	162
White-headed	162
Williamson's	162
Yellow-bellied	162, 163
Wren, Cactus	138
" " Cape	138
" Canon	138
" Golden-crested	136
Wren, Golden-crested, Cuvier's	137
" Great Carolina	138
" House	138
" Marsh, Long-billed	138
" " Short-billed	138
" Parkman's	138
" Rock	138
" Ruby-crowned	136
" Winter	138
Xanthocephalus	148
Xauthoura	154
Xema	207
Xenurus	110
Xiphias	236
Xyrichthys	236
Yaguarundi	63
Yarke	18
" Black	17
" Whisker	18
" Whitish	18
Yellow-bird	143
Yellow-tail	240
Zalopus	77
Zapus	98
Zenaida	178
Zenaidura	178
Zonotrichia	144
Zygodactyla	279

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